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BSP901R USER MANUAL
With the NIR SENSOR

BSP901RNIRD-115
BSP901RNIRW-115
BSP901RNIRDW-115
BSP901RNIRWW-115

230V Systems use a step-down transformer

MOISTURE MONITORING AND
CONTROL SYSTEM WITH AUTO GAIN

Software Version 4.0 & 4.1
Manual P/N 551117-003

This is a general user manual for the BSP-901RNIR Moisture Monitoring and Control System. It contains a description of the system and its components, guidelines for installation, and instructions for on-line operation. We strongly recommend that you review this manual before using your BSP-901 System.
The information in this manual has been carefully checked and is believed to be entirely reliable. However, no responsibility is assumed for inaccuracies. Furthermore, Moisture Register Products reserves the right to make changes without prior notice to any products herein to improve reliability, function, or design.

BSP901R With NIR Sensor

OPERATING INSTRUCTIONS

Software Version 4.0 & 4.1
Manual P/N 551117-003

REV	E.O.	DESCRIPTION	DATE	APPROVED
A		Release of Auto Gain	4/01	RS/GC
B	31988	Addition of Wide Range	1/02	RS/GC
C	32032	Clarify Output Scaling	5/02	RS/GC
D	32111	Adjusted Dark and LOP Levels	1/03	RS/GC
E	32114	Updated Figure 3, Display, Drwg List	9/04	RS

The checked box applies to the BSP901 System provided for your application.

- ☐ BSP901RNIRD-115
  BSP901 Auto Range NIR System Dry Filters
- ☐ BSP901RNIRW-115
  BSP901 Auto Range NIR System Wet Filters
- ☐ BSP901RNIRDW-115
  BSP901 Auto Wide Range NIR System Dry Filters
- ☐ BS901RNIRWW-115
  BSP901 Auto Wide Range NIR System Wet Filters

230V Units use a step-down transformer

TABLE OF DRAWINGS AND DIAGRAMS

TABLE OF CONTENTS

DESCRIPTION

The BSP-901 Moisture Analyzer is a single-channel, microprocessor-based, continuous moisture monitoring and control system which provides repeatability, flexibility, and drift free operation.

The key features of the BSP-901 include:

1. A sealed touch-keyboard for simple operation.
2. Storage of up to five (5) separate two or three point calibration tables.
3. High-low moisture alarm levels with alarm relays.
4. Automatic loss of product detection.
5. Proportional Integral Derivative (PID) feedback control.
6. Security user identification code to prevent unauthorized tampering.
7. Blow period for use with the OPTO-PORT attachment.
8. Sample-on-command.
9. Programmable smoothing to reduce undesired moisture fluctuations.
10. Non-volatile battery backup memory.

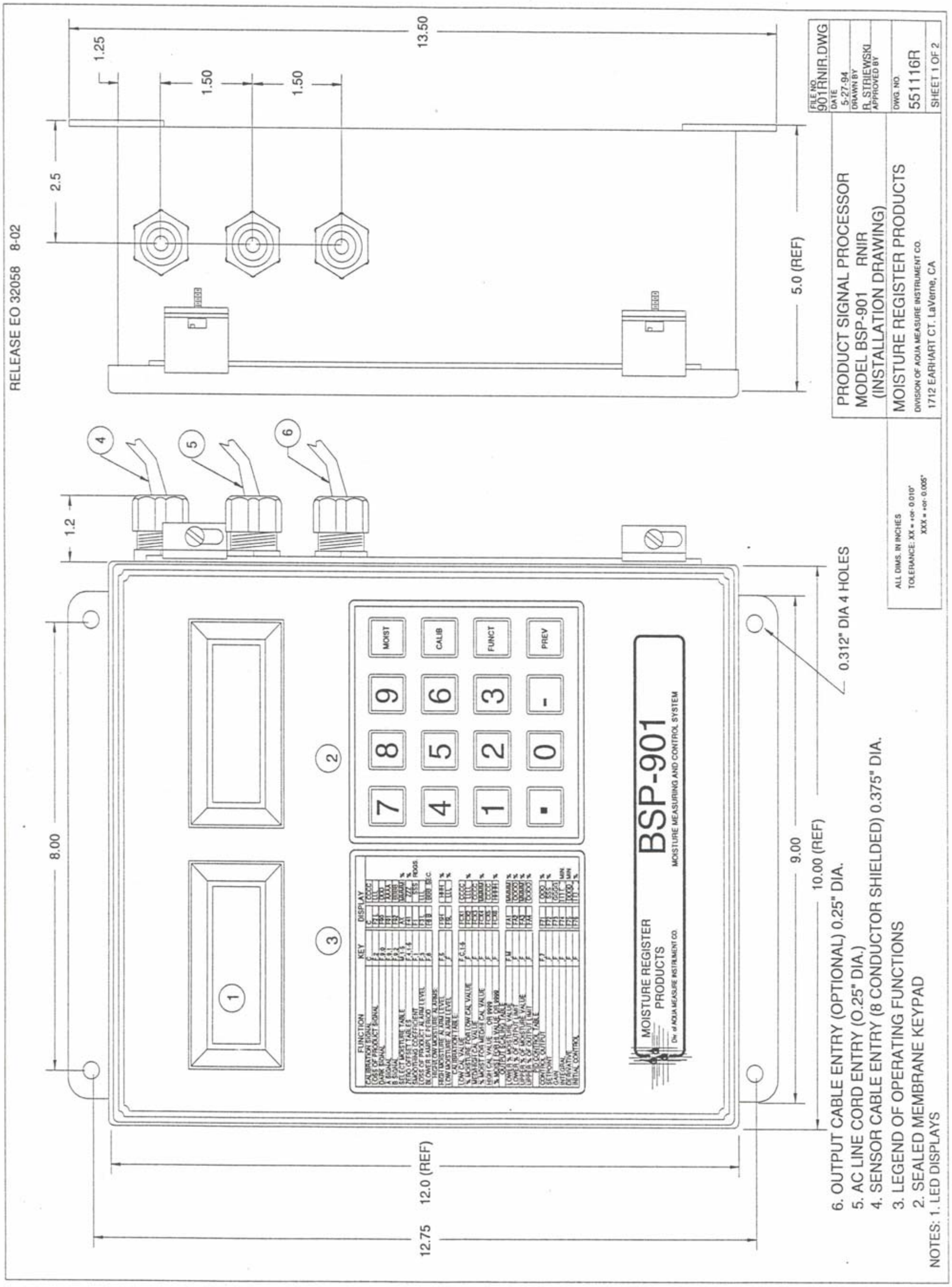
Your BSP-901 system consists of:

1. NEMA-12 wall mounted BSP-901 Console.
2. Infrared moisture measuring Sensor, Sensor Power Supply Box and two (2) interconnecting cables (25-feet length each), **or** one Radio Frequency (RF) Sensor.
3. 10-Pin Sensor connector cable from Sensor to BSP-901 Console, (length specified by user, 1000 ft maximum).
4. BSP-901 Instruction manual.
5. Isolation transformer.
6. Spare parts kit.

BSP-901 CONTROL CONSOLE (See Figure 1.)

The front panel of the BSP-901 Console consists of:

1. Two (2) 4-digit sealed LCD displays. The left display will show a letter, or a series of letters showing the current mode of operation and overflow digits from right display. The right display will display moisture or other data relevant to the current mode selected.
2. Sealed touch-key keyboard for entry of all programmable data and mode selection.
3. Legend of operating functions.
4. Cable entry for 9-conductor sensor cable. (Right side of console)
5. Cable entry for 115VAC power cable. (Right side of console)
6. Cable entry for output or alarm cables. (Right side of console)



RELEASE EO 32058 8-02
13.50
1.25
1.50
1.50
2.5
5.0 (REF)
1.2
8.00
9.00
10.00 (REF)
12.0 (REF)
12.75
0.312" DIA 4 HOLES
MOIST
CALIB
FUNCT
PREV
BSP-901
MOISTURE MEASURING AND CONTROL SYSTEM
MOISTURE REGISTER PRODUCTS
Div. of AQUA MEASURE INSTRUMENT CO.
NOTES: 1. LED DISPLAYS
2. SEALED MEMBRANE KEYPAD
3. LEGEND OF OPERATING FUNCTIONS
4. SENSOR CABLE ENTRY (8 CONDUCTOR SHIELDED) 0.375" DIA.
5. AC LINE CORD ENTRY (0.25" DIA.)
6. OUTPUT CABLE ENTRY (OPTIONAL) 0.25" DIA.
ALL DIMS. IN INCHES
TOLERANCE: XX = +or- 0.010"
XXX = +or- 0.005"
PRODUCT SIGNAL PROCESSOR
MODEL BSP-901 RNIR
(INSTALLATION DRAWING)
MOISTURE REGISTER PRODUCTS
DIVISION OF AQUA MEASURE INSTRUMENT CO.
1712 EARHART CT. LaVerne, CA
FILE NO. 901RNIR.DWG
DATE 5-27-94
DRAWN BY R. STRIEWSKI
APPROVED BY
DWG. NO. 551116R
SHEET 1 OF 2

BSP-901 NIR SENSOR

The NIR Sensor is constructed of anodized aluminum, assembled with 18-8 stainless steel hardware and sealed with O-rings to provide maximum protection to the enclosed electronics and to the material being measured. The NIR Sensor is capable of withstanding a periodic wash-down with no possibility of internal damage.

The NIR Sensor contains all the electronic and NIR components required to supply stable signals for processing to the BSP-901 Electronic Console. The NIR Sensor is connected to the NIR Power Box by two separate cables.

The near infrared reflectance sensor is designed to send a 4 to 20 milliampere current signal to the BSP-901 console. The moisture signal is a time multiplexed composite of the dark signal, A-filter, and B-filter amplitudes. The sync pulse allows the console to synchronize to and sample the input signal at the proper time. The optional Wide Range NIR Sensor provides more sensitivity for both dark and light products with a trade off of limited Loss Of Product indication.

NIR SENSOR INSTALLATION

The NIR Sensor can be mounted on a angle iron or a 1/2” pipe (0.84 O.D.) using two 1/4-20 screws. (See Drawing No. MRC003842). The NIR Sensor must be installed over the product at a focal distance of 9" / 288 mm ± 1" / 25 mm.

Make sure that the NIR Sensor is not exposed to direct sun light. If possible use a shroud over the NIR Sensor and the product being measured.

The NIR Sensor, NIR Power Box and BSP-901 Console should not be exposed to ambient temperatures greater than 122°F/50°C. Operating Minimum: 30°F/0°C, Storage Maximum 176°F/80°C., Storage Minimum 0°F/-18°C.

PHYSICAL DESCRIPTION OF THE NIR SENSOR

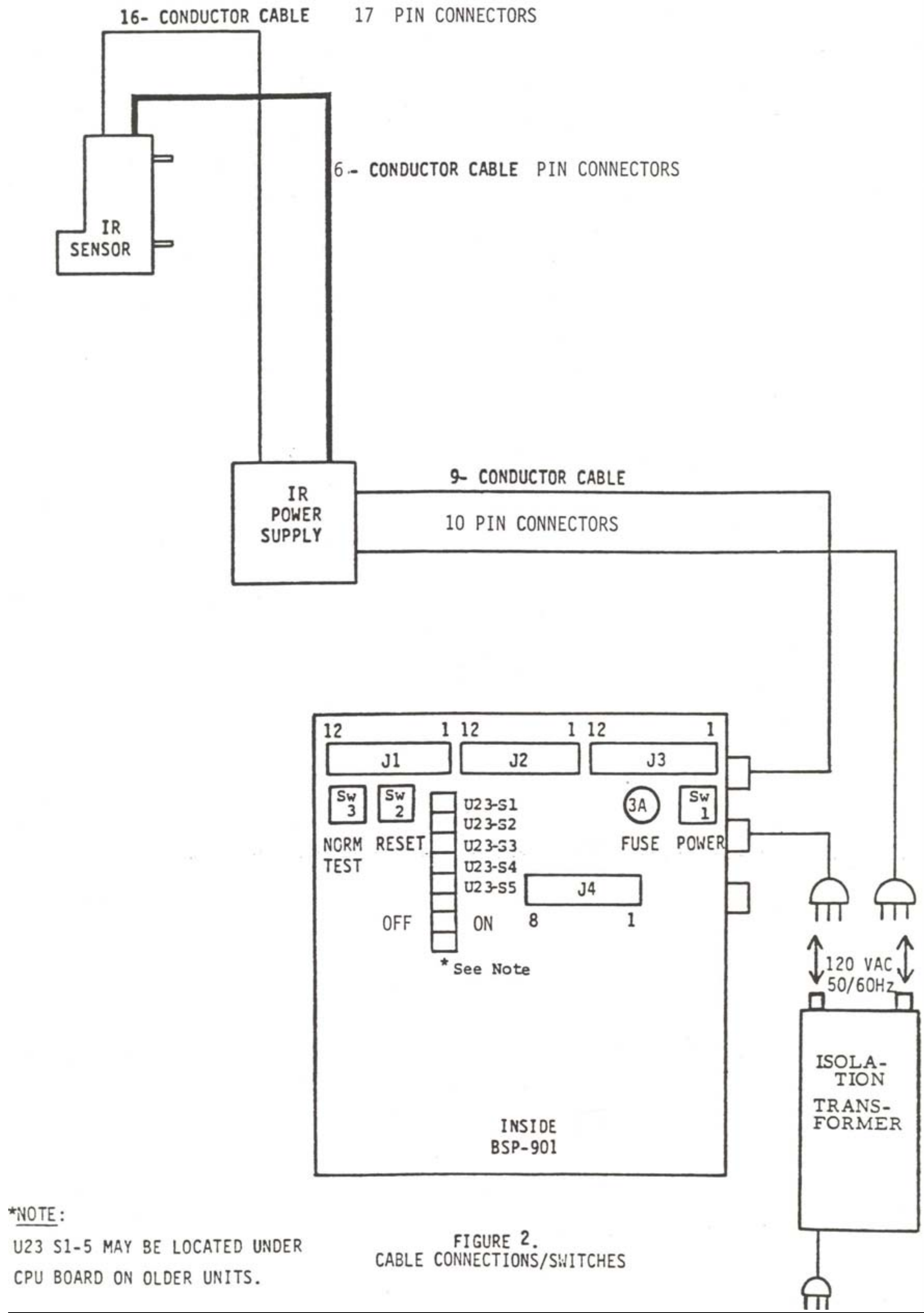
The NIR Sensor consists of the following components:

- NIR Sensor Housing (Aluminum Black Anodized)
- NIR Power Supply Box (Gray Box or Beige Box)
- Two interconnecting cables, 6 Ft.

The NIR Sensor housing contains:

- NIR Source (quartz halogen lamp)
- Optics
- Filters on a rotating wheel (powered by a 120VAC induction motor)
- Cooled Lead Sulfide Detector Cell
- Preamplifier Board

Caution	*The Allowable temperatures for the NIR Sensor are:* *Operating Maximum: 122℉ / 50℃* *Operating Minimum: 30℉ / 0℃* *Storage Maximum: 176℉ / 80℃* *Storage Minimum: 0℉ / -18℃* *Distance, Lens to product: 9”/228mm ± 1”/25mm*



*NOTE:
U23 S1-5 MAY BE LOCATED UNDER CPU BOARD ON OLDER UNITS.

FIGURE 2.
CABLE CONNECTIONS/SWITCHES

NIR POWER SUPPLY BOX

The NIR Power Supply Box (the gray box or beige box) must be mounted/located near the NIR Sensor so that the two 25 feet lengths of cable can be connected. Refer to Figures 2 and 3.

You will also need 120VAC/60 Hz power for the NIR Power Supply Box.

A step-down isolation transformer is supplied for 220VAC/50Hz power.

CABLE CONNECTIONS (See Figure 2)

There are two cables from the NIR Sensor to the Power Supply Box. The smaller six-wire cable carries 120V AC for the motor and 5VDC for the lamp. The thicker 15-conductor plus shield cable carries all the analog signals and cooler current to the photocell.

There is one cable from the BSP-901 Console to the Power Supply Box. This eight-conductor plus shield cable carries the analog signals and analog power.

The 120V AC line cable to the Power Supply Box is supplied with a three prong plug that can be easily removed so that the Power Supply Box may be wired directly to a junction box, or to the isolation transformer.

INSTALLATION

After the NIR Sensor and Power Supply are mounted (See figure 3), perform the following steps:

1. Connect the 17-pin connector cable and the 6-pin connector cable to their appropriate fittings from the Sensor to the Power Supply.
2. Connect the 10-pin connector cable to the Power Supply Box, then connect the cable to the terminal strip inside the BSP-901 Console. (See Figure 4).
3. Plug the AC power cable from the NIR Power Supply Box into the isolation transformer. (See Figure 2.)
4. Plug the AC power cable from the BSP-901 Console into the isolation transformer. (See Figure 2.)
5. Open the NIR Power Supply Box door and flip the toggle switch to the "ON" position. You should see a light shining from the bottom lens of the NIR Sensor.

Caution

If the 120VAC line you are using is also used for large equipment where electrical noise occurs, or you desire 240VAC, we recommend that an isolation transformer be used.

Your BSP-901 system is equipped with a 125VAC Isolation Transformer. 50/60Hz /120VAC or 240VAC IN 120VAC OUT is advised. The NIR Power Supply Box and the BSP-901 Console must be fed from the 120VAC output of the isolation transformer as described in 3, and 5, above. When this transformer is used, it is typically connected with conduit instead of using the three (3) prong plug provided. This is recommended because the conduit acts as an electrical shield to prevent noise from being picked up by the 110VAC lines.

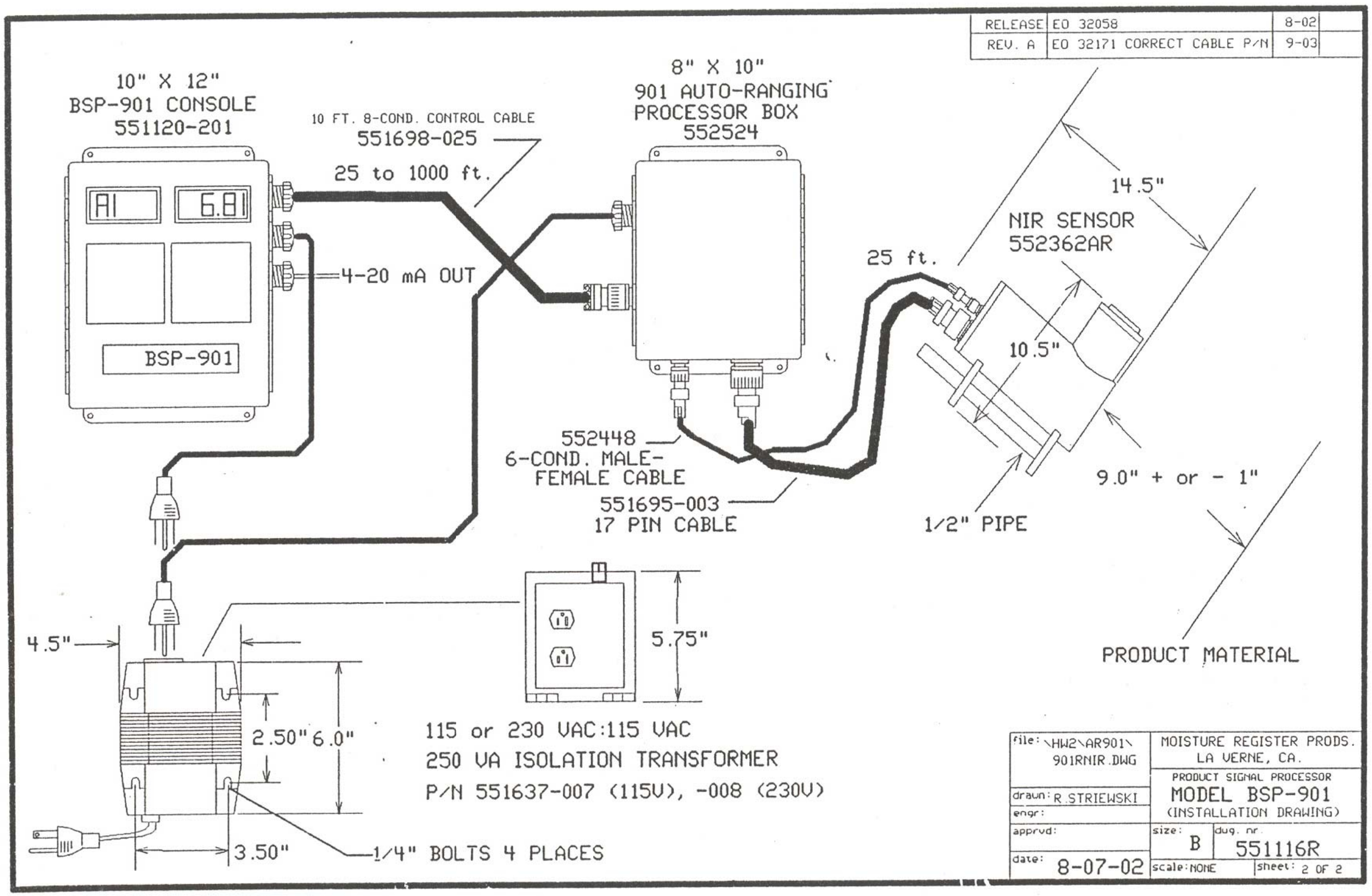


Figure 3

Mounting and Installation

USER'S CONNECTION OF THE SENSOR CABLE TO THE BSP-901 CONSOLE

SENSOR PLUG PIN # OR LETTER	SENSOR CABLE COLOR	BSP-901 TERMINAL
METAL	CONNECTORS	J1
A	BROWN	11
B	YELLOW	1
C	GREEN	5
D	RED	7
E	WHITE	9
F	BLUE	4
G	ORANGE	12
H	WHT/BLK SHIELD	OPEN
J	BLACK	SPARE

FIGURE 4.
10-PIN CONNECTOR

Important

SEE APPENDIX "A" FOR THE LIST OF OUTPUT CONNECTIONS TO USER'S EQUIPMENT, AND AC POWER.

HOW TO USE THIS MANUAL

For instructional purposes, this manual illustrates the KEY ACTION to be performed and the DISPLAY READINGS in the following manner:

KEY ACTION	DISPLAY READINGS LEFT	DISPLAY READINGS RIGHT
[ ]	[ ]	[ ]
Denotes Key	Denotes Display	

FOR EXAMPLE:
The right box in **[FC11] [CCCC]** indicates that the data on the right display was found in the table as specified by the left display.

In example **[FC11] [CCCC]**
the data was found in Calibration Table #1,
Calibration point 1. CCCC simply represents that 4 numbers (Calibration value) will be present in this display.

The left box in **[FC11] [1893]** indicates that the **data entered from the keyboard** (viewed in the right display) is to be stored in the calibration table as specified by the left display. In this example the data is to be stored in Calibration Table #1 after the F, C, M, or P key is pressed.

When using your BSP-901 System for the first time, the display values will be random (depending on the calibration data or other parameters previously entered) and are represented in this manual by letters which have the following meaning:

"A"	=	Moisture Display or A-Signal	"I"	=	Integral or Initial Control
"B"	=	Blower Sample Period or B-Signal	"L"	=	Low moisture or Loss of Product Signal Level
"C"	=	Calibration Signal/Data	"M"	=	Moisture Signal/Data
"D"	=	Derivative or Dark Signal	"O"	=	Output
"F"	=	Function Select	"P"	=	Previous Entry
"G"	=	Gain	"S"	=	Smoothing or set point
"H"	=	High Moisture	"Z"	=	Zero Offset

INITIAL START UP

Before performing the initial start up, check the following:

All cable connections as directed.

All AC connections made.

Console and NIR Power Supply Box properly mounted.

NIR Sensor looking at product.

You are now ready to perform the initial start up.

STEP 1: POWERING UP

Turn on power with the toggle switch S1 located on the upper right hand corner of the circuit board inside the BSP-901 console.

The TEST/NORMAL switch SW3 should be in the NORMAL position. Turn on the Power Box if not already on.

See Figure 2 for location of switches and buttons.

STEP 2: INITIALIZING THE BSP-901

Due to shipping and possible long storage time, the BSP battery may be low, causing the memory to contain incorrect information. To initialize all parameters in the unit, perform the following:

PRESS KEYS **FUNCT** **0** **2** **3** **4** **FUNCT** **BSP-** **901**

This initialization sets the BSP-901 to a factory set of parameters.

CAUTION! PRESSING **FUNCT** **0** **2** **3** **4** **FUNCT**

WILL ERASE ALL DATA STORED.

If your console fails to respond to initialization, perform the following:

Enter the user security code (see Option 4) page 30,

OR

Disable the user code by opening the console door and turning switch U23- Sw4 to the "ON" position, then pressing the Reset Button Sw2.

If the system fails to respond after performing one of the above actions:

Check all AC connections.

Check all Cable connections.

Check the Pin connections (See Figure 4) page 7. If you still get no response: **Call Moisture Register Products and ask for Customer Service**.

After initializing the BSP-901, you are ready to calibrate the 901 to read moisture.

Function	Key	Display Left	Right	
Calibration Signal	C	C	CCCC	
Loss of Product Signal	F,2	F2 L	LLL	
Dark Signal	F,9,0	F90	DDD	
A Signal	F,9,1	F91	AAAA	
B Signal	F,9,2	F92	BBBB	
Select Moisture Table	M,1-5	AX	MMMM	%
Zero Offset Tables	F,4,1-5	F41	ZZZ	%
Smoothing Coefficient	F1	F1	SSS	RDGS.
Loss of Product Alarm Level	F,3	F3 L	LLL	
Blower Sample Period	F,6	F6 B	BBB	SEC
High/Low Moisture Alarm				
High Moisture Alarm	F,5	FS H	HHH	%
Low Moisture Alarm	F	F5L	LLL	%
Calibration Table				
Low Cal Value	F,C,1-5	FCX1	CCCC	
% Moisture For Low Cal Value	,F	FCX2	LLLL	%
Med/High Cal Value	,F	FCX3	CCCC	
% Moisture For Med/HI Cal Value	,F	FCX4	MMMM	%
High Cal Value or 9999	,F	FCX5	CCCC	
% Moisture For Hi-Value or 9999	,F	FCX6	HHHH	%
Output Scaling Table				
Lower % Moisture Value	F,M	FA1	MMMM	%
Lower % of Output Limit	,F	FA2	OOOO	%
Upper % Moisture Value	,F	FA3	MMMM	%
Upper % of Output Limit	,F	FA4	OOOO	%
PID Control Table				
Control Output	F7	F71	OOO	%
Set Point	,F	F72	SSS	%
Gain	,F	F73	GGGG	
Integral	,F	F74	I I I I	MIN
Derivative	,F	F75	DDDD	MIN
Initial Control	,F	F76	I I I	%

CHECKING DISPLAY AFTER POWER UP

1) If display shows 8 moving single segments, decimal points and pairs of 8’s, the display board is in self test mode. This can happen only if there is a missing signal from its ribbon cable. Check the ribbon cable connectors at both ends for full contact.

2) If the display interrupts its reading with “no Prod”, check for any of the following:
   a) Sensor power as down or turned off.
   b) Sensor cable not connected.
   c) Sensor lens is dirty.
   d) Sensor signal from product is weak or lamp is dim
   e) Norm/Test switch is in wrong position.

See Page 22 on how to remove the Loss of Product Alarm for further troubleshooting.

STEP 1: CHECKING SIGNAL LEVELS

With the NIR Sensor looking at the product, you will check the following three signal levels:

Calibration Signal.
Loss of Product Signal.
Dark Signal.

1.1 CALIBRATION SIGNAL

The calibration signal is a number computed by the BSP-901 system Which will vary with moisture levels and will be used to calibrate your BSP-901.
The calibration signal is derived from the difference between the Reference filter reading and the dark filter reading, and dividing the results by the difference between the moisture filter reading and the dark filter reading as follows:

$$\text{Calibration Signal} = \frac{\text{Reference Signal} - \text{Dark}}{\text{Moisture Signal} - \text{Dark}}$$

To view the Calibration Signal;

Press Key	**CALIB**	**C**	**C.CCC**

Based on the computation above, the calibration signal displayed will be a number proportional to the moisture measured.

Important	*If you have an NIR Sensor, an increase in moisture will result in an increase in calibration Signal. f you have an RF (Radio Frequency) Sensor, an increase in moisture will result in a decrease in calibration signal. (See RF Section for set-up and calibration of RF Sensors).*

INTERNAL SENSOR SIMULATOR NIR OR RF

Inside the BSP-901 Console is a switch labeled NORM/TEST (Sw3). If you place this switch in the "TEST" position and then press the "RESET" button, the BSP-901 will disconnect the external sensor and replace it with an internal test circuit that simulates the sensor output signals.

In the test mode press the key **CALIB**

The BSP-901 should display 1.000 ± .005 while viewing the calibration signal in the test mode.

Important

Use this procedure only to troubleshoot the BSP-901 Console.

To set the unit for on-line operation, place the NORM/TEST switch in the NORM position, then press the RESET button.

STEP 1: CHECKING SIGNAL LEVELS (Continued).

1.2 LOSS OF PRODUCT SIGNAL

The Loss of Product (L.O.P.) signal is used for two purposes;

1) to set the gain for the NIR Sensor input, and

2) to detect a loss of product condition. It can also be used to alarm of such a condition. (See Programmable Function 2 - Loss of Product Level).

Press Keys	**FUNCT**	**2**	**F2**	**LLLL**

Make sure that the product being measured is at a focal distance of 9” ±1”.

1.3 LOSS OF PRODUCT SIGNAL (AUTO RANGING GAIN)

Note: It is not necessary to open the NIR Sensor Power Supply Box other than to turn it on.

The loss of Product (L.O.P.) signal in systems with the BSP-901 Auto-Ranging NIR Sensor Power Supply Box is used to detect a Loss of Product and to alarm of such a condition. The Loss of Product can be viewed by doing the following:

Press Keys **FUNCT** **2** **F2** **LLLL**

Observe that the L.O.P. Signal will show two different value levels up to several seconds apart. The values will range between 150 and 400 counts apart for a dry or wet product. This is due to the dynamic auto-ranging gain adjust of the system.

Your system will accurately measure moisture with the L.O.P. levels anywhere between 800 and 3300.

1.4 DARK SIGNAL

To view the Dark Signal:

Press Keys **FUNCT** **9** **0** **F90** **000**

Auto Gain Systems will always show a fixed number near 68* within a couple of counts. This is normal for the operation of the System.

* Note: 430 for pre-2003 systems.

You are now ready to begin collecting data for calibrating your BSP-901 System.

STEP 2: COLLECTING DATA

2.1 To begin collecting data for calibrating your BSP-901, start with the dry end of your moisture range. For example, if your total range of moisture for the product is 10-20 percent, adjust your process so the moisture content drops down to around 10 percent.

With the sensor looking at your product, view the CALIBRATION SIGNAL:

Press Key **CALIB** **C** **C.CCC**

> **Important**
> *After pressing the Key* ***CALIB*** *the signal may fluctuate.*
> *Refer to Programmable Function 1 - Smoothing Coefficient, to generate a running average of the signal.*

2.2 Take a total of ten typical samples at the dry end 10% (ten percent). Write down the calibration signal for each sample that the sensor views.

2.3 Place the samples in airtight containers and mark the corresponding calibration signal on the containers. Take the containers to your laboratory for moisture analysis. Use only standard moisture analysis techniques such as air oven, vacuum oven, Karl Fisher, Titration, Model MC "Moisture Computer", etc.

Follow this same procedure for ten samples at the high (wet) end of your product moisture range.

2.4 You must establish at least two points for your calibration curve. For higher resolution, however, you may want to calibrate and include a third point.

Do this by taking ten samples in the mid range; for example, the 15 percent moisture range.

If you choose to do a 3-point calibration, you will have thirty calibration signals:

Ten for the high-level moisture content.
Ten for the mid-level moisture content.
Ten for the low-level moisture content.

This is a dynamic calibration procedure. Of course, the more data gathered the more finely tuned your calibration will be. You may, however, quickly establish a static calibration based on sampling off line products of known moisture content.

Make a copy of appendix "C" to write down your calibration numbers.

STEP 2: COLLECTING DATA (Continued)

2.5 Static Calibration

You can do a quick static calibration using the procedure outline above by taking samples of known moisture contents, presenting them to the sensor and writing down the calibration signals.

2.6 There are two options for treating the data you have just collected:

1. You can do a linear regression, if desired.
2. You can average the calibration signal and moistures to obtain your three moisture data points. For Example:

CALIBRATION TABLE NO. 1

LO RANGE			MED RANGE		HI RANGE	
SAMPLE(S)	DRY	CAL SIGNAL	MED.	CAL SIGNAL	WET	CAL SIGNAL
Sample 1	10.1%	1.100	15.1%	1.500	20.1%	1.900
Sample 2	10.2%	1.08	15.0%	1.492	20.05	1.892
Sample 3	9.80%	1.075	15.2%	1.508	19.8%	1.876
Sample 4	10.0%	1.092	15.0%	1.492	20.2%	1.908
Sample 5	10.3%	1.111	15.0%	1.492	20.1%	1.900
Sample 6	10.1%	1.100	14.9%	1.484	19.95	1.884
Sample 7	9,70%	1.068	15.1%	1.500	20.1%	1.900
Sample 8	10.2%	1.108	14.8%	1.476	20.0%	1.892
Sample 9	10.1%	1.100	15.2%	1.508	20.0%	1.840
Sample 10	10.0%	1.092	15.0%	1.492	20.0%	1.884
Average	**10.05%**	**1.096**	**15.03%**	**1.494**	**20.01%**	**1.893**

This Example provides three data points for measuring moisture:

First Data Point - LO: (DRY) 10.05% = 1.096 Cal. Signal.
Second Data Point - MED: (MIDDLE) 15.03% = 1.494 Cal. Signal.
Third Data Point - HI: (WET) 20.01% = 1.893 Cal. Signal.

When your own Data Points are calculated, you will be ready to enter them into your calibration table.

Important

Always begin a process start-up with a smoothing co-efficient of ***1*** *to avoid long delays of moisture readings. Enter desired amount of filtering as required by the process being monitored.*

A smoothing co-efficient value entered on ***FUNCT*** ***1*** *will affect all five calibration tables.*

STEP 3: ENTERING YOUR MOISTURE DATA INTO THE BSP-901

The BSP-901 has memory for up to five separate 2 or 3-point calibration tables. This feature is extremely valuable if you run different products requiring different calibrations on the same process line. For additional product tables the Remote Operator option is available. Once the tables are calibrated, the push of only two keys automatically switches the BSP-901 to the calibration table of the product being run. Obviously, the gain needs to be rechecked, to make sure that both Loss of Product and Dark Signal are still in the desired ranges.

3.1 TO ENTER DATA FOR CALIBRATION TABLE NO. 1

Point No. 1 of Table No. 1

Press Keys **FUNCT** **CALIB** **1** — **FC11** **CCCC**

3.2 Enter your Low (dry moisture) Calibration Signal first (in our example - Calibration Signal 1.096). Always enter the Low Calibration Signal moisture first into the first calibration point.

Press Keys **1** **.** **0** **9** **6** — **FC11** **1.096**

3.3 Press Key **FUNCT** — **FC12** **MMMM**

Enter the Low (dry) Moisture Reading that corresponds to the Low Calibration Signal.

(In our example - moisture is 10.05%).

Press Keys **1** **0** **.** **0** **5** — **FC12** **10.05**

3.4 Press Key **FUNCT** — **FC13** **CCCC**

Enter the Medium or second Calibration Signal (in our example 1.494)

Point No. 2 of Table No. 1

Press Keys **1** **.** **4** **9** **4** — **FC13** **1.494**

3.5 Press Key **FUNCT** — **FC14** **MMMM**

Enter the Medium Moisture Reading corresponding to the Medium or second Calibration Signal. (In our example 15.03%.)

Press Keys **1** **5** **.** **0** **3** — **FC14** **15.03**

3.6 Press Key **FUNCT** — **FC15** **CCCC**

STEP 3: ENTERING MOISTURE DATA INTO THE BSP-901 (Continued).

> **Important**
>
> *If you use only two calibration points, YOU MUST enter four nines (9999) TWICE to tell the BSP-901 that this is the end of the calibration data.*
>
> *Press Keys* [*9*] [*9*] [*9*] [*9*] [***FUNCT***] [*9*] [*9*] [*9*] [*9*] [***FUNCT***]
>
> *Skip to paragraph 3.8 if only two calibration points are used.*

If you choose to enter the third Calibration Signal, enter the data as follows:

Point No. 3 of Table No. 1

Enter the High or third Calibration Signal (In our example 1.893)

	Keys					Display	
Press Keys	**1**	**.**	**8**	**9**	**3**	**FC15**	**1.893**

3.7 Press Key **FUNCT** — **FC16** **MMMM**

Enter the Wet or third Moisture level that corresponds to the third calibration signal. (In our example 20.01%.)

	Keys					Display	
Press Keys	**2**	**0**	**.**	**0**	**1**	**FC16**	**20.01**

To complete the entry of Calibration Table No. 1:

Press Key **FUNCT** — **F** [ ]

You are now reading moisture. — **A1** **MMMM**

This will enter the data in memory and should be performed each time a calibration change is made to the Calibration Table.

To enter into memory data for the other four Calibration Tables, start Calibration Table No. 2 as follows:

Press Keys **FUNCT** **CALIB** **2** — **FC21** **CCCC**

Then repeat steps from Paragraph 3.2 to 3.7

3.8 Use the same procedure as outlined above to enter data into Calibration Tables 3 to 5.

RF SENSOR CALIBRATION

This manual is for the NIR Sensors, however RF Sensors can also be used with this system.
When using RF sensors, the High Moisture is entered after the first Calibration Signal and then the Low Moisture after the last Calibration Signal.

Example:

First Calibration Signal	.300
First Moisture Percent	20%
Second Calibration Signal	.500
Second Moisture Percent	15%
Third Calibration Signal	1.000
Third Moisture Percent	2%

Refer to the RF Manual Part No. 551117-002 for Calibration.

STEP 4: READING MOISTURE

4.1 To read Moisture using Calibration Table No. 1:

Press Keys **[MOIST]** **[1]** **[A1]** **[M.M]**

> **Important**
> *Before entering M1, Make sure that there is not an "F" in the left display from a previous operation. An "F" in the display will result in this command being entered as an "FM1" command.*

If Calibration Table No. 1 has been set up as a two-point table, the BSP-901 will construct a linear relationship of calibration signal to percent moisture. If Calibration Table No. 1 has been set up as a three point table, then starting from the middle calibration point, two linear relationships will be constructed, one to intersect with the high calibration point and the other to intersect with the low calibration point. This will create a curve fit that is a linear approximation of a non- linear function. The three-point table is recommended for highest accuracy as it has the ability to correct for non-linearity's that may be present.

4.2 To read the moisture levels from Calibration Table 2, 3, 4, or 5:

Press Keys **[MOIST]** **[2]** **or just** **[2]** etc**.**

PROGRAMMABLE FUNCTIONS

FUNCTION 1 - SMOOTHING (Damping) COEFFICIENT

The SMOOTHING COEFFICIENT is used to average a number of signals before updating the moisture reading on your display. It provides a running moisture average based on time. The BSP-901 updates internally at seven times per second; therefore, a smoothing coefficient of 70 would provide a 10 second running average on the display, although the display still updates every second. The highest permissible smoothing coefficient is **450**, the smallest smoothing coefficient is **1**.

1.1 Press Keys **[FUNCT]** **[1]** **[F1]** **[SS]**

1.2 To enter a smoothing coefficient of 70.

Press Keys **[7]** **[0]** **[F1]** **[70]**

1.3 Press Key **[MOIST]** to view the entry and go to the next function.

FUNCTION 2 - LOSS OF PRODUCT ALARM LEVELS

The LOSS OF PRODUCT LEVEL is an alarm detected by the system that there is no product under the sensor. When a loss of product condition occurs, the BSP-901 will flash its last moisture reading. This reading can be used to set an alarm of such condition when it reoccurs. To select the proper loss level, your sensor must be installed on-line.

Loss of Product Signal Determination

2.1 To determine the Loss of Product Signal (LPS), you need to select Function F2 - LOSS OF PRODUCT SIGNAL.

Press Keys	**FUNCT**	**2**	**F2**	**LLLL**

2.1.1 With the sensor looking **at no product**, record the loss of product signal. For Auto Gain Systems record both levels.

2.1.2 With the sensor looking **at product**, record the loss of product signal. For Auto Gain Systems record both levels.

Set Point Determination

2.2 To determine your set point for the loss of product, you need to select Function F3 - LOSS OF PRODUCT LEVEL.

Press Keys	**FUNCT**	**3**	**F3**	**LLLL**

2.3 You must now enter a signal level between the LPS looking at product and LPS looking at no product. This signal becomes your set point.

For Example: If your LPS looking **at product** is 2200 & 2000 the LPS looking at **no product** is 900 and 1200, you might select and enter a set point of 1400. This set point must be entered as a minus (-1400) because it is below the LPS looking at product; which in this example is 2000. (Enter negative sign as the last key entry).

Illustrated:		
	LPS with product:	2000 & 2200
	Set point:	-1400 (Selected between 1200 & 2000,
	LPS no product	900 & 1200 entered as minus).

The set point is entered as positive if it is above the LPS looking at no product. This condition is possible depending on the NIR reflectance of the background.

LOSS OF PRODUCT ALARM LEVEL (Continued)

Example:	LPS with Product	2000 & 2200	
	Set point:	2400	(Selected between 2200 & 2500, entered as positive).
	LPS no Product	2500 & 2700	

> **Important** The Loss Of Product set point entered applies to all five Calibration Tables and may or may not need to be reset for each Calibration Table, depending on point chosen.

2.4 To enter your signal level

Press Keys **FUNCT** then press Key **3** to verify entry.

Audible Alarm for Loss of Product

The loss of product set point provides a solid-state closure located at terminal strip J4, at terminals 1 and 2, which can be used to install an audible alarm. This closure is rated 0.5 Amps, 24 to 28 VAC. (See Fig. 2 for installation).

When the alarm condition occurs, the alarm will sound and the display will flash. Alarm reset occurs automatically when product reappears.

> **Important** *If the Loss Of Product alarm feature is not desired, program a **0** in function **F3. This can be done while the display is flashing "no Prod". Just press F 3 0 C Keys.***

Caution

CAUTION!

The Solid State Relays used are rated at 24 -28 VAC 0.5 Amps.

It is recommended that a 24 VAC transformer capable of at least 2 amps be used.

The following transformers are recommended:

1). SOLA type CE050RP 230/115/24 VAC 50/60Hz 50VA SOLID EPOXY ENCAPSULATED. NEWARK ELECTRONICS stock no, 52F7306

2). ALLIED type MT50PG 240/120/24 VAC 50/60Hz 50VA MOLDED TERMINALS & VARNISH IMPREGNATED SEAL. ALLIED ELECTRONICS INC. stock no. 836-9080

FUNCTION 4 - ZERO OFFSET

The ZERO OFFSET is used to correct your moisture readings. It is programmed in plus (+) or minus (-) percent moisture content. For example, if the BSP-901 is consistently reading +0.2% moisture content higher than your laboratory test results, you can offset the BSP reading by a (minus)" - 0.2%" to correlate with the laboratory results. Entering a value in Zero Offset will add this value or subtract it from the actual moisture reading. It affects all the calibration points entered in the calibration table.

4.1 Zero Offset - Table No. 1

Press Keys **[FUNCT]** **[4]** **[1]** **[F41]** **[Z.ZZ]**

4.2 Enter your Zero Offset value (example" - 0.2%")

Press Keys **[-]** **[.]** **[.2]** **[F41]** **[-0.20]**

For Tables 2, 3, 4, and 5 follow the above procedure substituting the Table number in Step 4.1.

If no offset is desired then program a zero. **[0]**

Important *Each of the five Calibration Tables can have a separate and independent Zero Offset.*

FUNCTION 5 - HIGH - LOW ALARM LEVEL

The HIGH-LOW MOISTURE ALARM occurs when the product's moisture exceeds pre-set values, which are programmed in percentage of moisture content.

A solid-state relay closure will occur at terminal strip J4, terminals 3 and 4 for high moisture and terminals 5 and 6 for low moisture.

These relay closures are rated at 0.5 Amps 24 to 28VAC and may be used for external audible alarm purposes.
(See Figure 3 for installation).

5.1 High Alarm Level

Press Keys **[FUNCT]** **[5]** — **[F5H]** **[100]**

5.2 Enter your Upper Alarm Limit (example 10%)

Press Keys **[1]** **[0]** — **[F5H]** **[10.0]**

5.3 Low Alarm Level

Press Keys **[FUNCT]** — **[F5L]** **[0.0]**

5.4 Enter your Lower alarm Limit (example 5%)

Press Keys **[5]** — **[F5L]** **[5.0]**

5.5 Press Keys **[FUNCT]** **[5]** **[FUNCT]** to verify entries

When the High Level Set Point is reached, the **"H"** flashes in the left display and the solid-state relay closes. And the audible alarm sounds if installed.

When the Low Level Set Point is reached the **"L"** flashes in the left display and the solid-state relay closes. And the audible alarm sounds if installed.

Important

The High - Low Alarm Set Point applies to all five Calibration Tables and may or may not need to be reset for each Calibration Table.

USER FUNCTIONS

OPTION 1: SAMPLE ON COMMAND

Sample on Command is used for applications where gaps occur during the process. With this function activated, the BSP-901 will not update when gaps occur and the display readings and the 4-20 mA output will lock at the last reading.

1.1 Sample on Command

To use this function, perform the following actions inside the BSP-901 Console:

1. Turn off Switch U23-S5
2. Push the Reset Switch
3. Connect a 24VAC or a 24VDC source to Pin 5 J2 (-) and Pin 6 J2 (+) through a gap-sensing device such as a micro switch or optical switch to turn voltage on and off.

The sensor samples the product only when the input to J2 Pins 5 and 6 is ON. i.e. when current is flowing into J2 Pins 5 and 6. The BSP-901 locks the reading and output of the last sampling when gaps occur. If no reference set point is used in FA5.

1.2 Sample on Command with Reference Set Point

This feature provides the ability to generate a reference set point when no current is flowing through J2 Pins 5 and 6.

The user can program a set point in percent moisture to the 4-20 mA output. The 4-20 mA is driven to the pre-programmed set point when the Sample on Command is OFF (zero current). This might be useful, for example, to prevent a strip chart recorder pen from returning to the left side of the scale in the absence of product flow.

To program this set point:

Press Keys	**FUNCT**	**MOIST**	**FUNCT**	**FUNCT**	**FUNCT**	**FUNCT**	**FA5**	**XXXX**

To Program a set point for 50 percent moisture:

Press Keys	**5**	**0**	**FA5**	**50**

If a set point of 50 percent is programmed and the output table is programmed to output 4mA for 0 (zero) percent moisture and 20 ma for 100 percent, then the output with the Sample on Command off (zero current) will go to 12 mA.

See Output Table next page.

OUTPUT TABLE

(Example for 50% set point)

Display				Set Point
FA1	0%		=	0% Moisture
FA2	0%	4mA	=	0% Current Span
FA3	100%		=	100% Moisture
FA4	100%	20mA	=	100% Current Span
FA5	50%	12mA	=	50% Moisture

READ THE PID SECTION BEFORE USING THIS OPTION

1.3 Sample on Command with PID

In this mode, the Sample on Command input switches the BSP-901 PID (Proportional, Integral, and Derivative) program from manual to automatic control and vice versa when current is applied or disconnected at the Sample on Command Terminals.

To use the PID function, perform the following actions inside the BSP-901 Console:

1. Turn off Switch U23-S5
2. Turn off Switch U23-S3
3. Turn off Switch U23-S1
4. Push the Reset Switch
5. Connect a 24VAC or 24VDC source to pins 5 J2 (-) and Pin J2 (+) through a micro switch to turn voltage ON and OFF.

OPTION 2:   OUTPUT SCALING

OUTPUT SCALING allows you to set your output to correspond with the moisture range desired, i.e. 4 mA = 10 percent moisture, 20 mA = 20 percent moisture. You can also program the percentage of the output, i.e. 7 mA = 10 percent moisture, 18 mA = 20 percent moisture.

2.1 To bring the output table to the display

Press Keys **FUNCT** **MOIST** & your entry **FA1** **MMMM**

Your display will read **FA1** where **1** is the entry number.

FA1 = lower percent moisture which provides the output given by entry number 2.

2.2 To advance the entry number:

Press Key **FUNCT** & your entry **FA2** **0000**

FA2 = percent of output for the lower moisture entered on **FA1**

Example #1 - An entry of "0" provides 0% of output which is equal to 4 mA

Example #2 - An entry of "10" provides 10% of output which is equal to 5.6 mA (10% of 16mA plus 4 mA).

2.3 To advance the entry number:

Press Key **FUNCT** & your entry **FA3** **MMMM**

FA3 = upper scaling percent moisture which provides the output given by entry **FA4**

2.4 To advance the entry number:

Press Key **FUNCT** & your entry **FA4** **100.0**

FA4 = percent of output for the upper moisture entered on **FA3**

Example #1 - An entry of "100" provides 100% of the output which is equal to 20 mA.

Example #2 - An entry of "80" provides 80% of the output which is equal to 16.8 mA. (80% of 16 mA spread plus 4 mA).

2.5 To return to any of the previous entry numbers:

Press Key **PREV**

Important	*You must go through the advance entry sequence to reach entry numbers 2 - 4.* *To exit Output Scaling you can press the* ***MOIST*** *or* ***CALIB*** *at any time.*

2.6 VOLTAGE OUTPUT

The BSP-901's output (4 - 20 mA) can be programmed to provide zero to "X" volts, with 5 VDC being the maximum output available.

To have a voltage output, a resistor of 1% tolerance needs to be connected across the 4 - 20 mA terminals. Refer to the chart below:

OUTPUT	RESISTOR NEEDED
0 to 20 MV	1 ohm
0 to 100 MV	5 ohms
0 to 200 MV	10 ohms
0 to 500 MV	25 ohms
0 to 1 VOLT	50 ohms
0 to 2 VOLT	100 ohms
0 to 5 VOLT	250 ohms

EXAMPLE: Your product moisture range is from 10% to 30% and you want to scale the output to correspond to a 0 to 5V. range, you must program for a 0 mA to 20 mA range using a 250 Ω(ohms) resistor.

To output a zero voltage level, scale the output by programming the **FM** functions.

Press Keys **FUNCT** **MOIST** **FA1** **MMMM**

Enter low moisture that will provide zero voltage output.

EXAMPLE: 10% Moisture (**Step 1**)

Press Keys **1** **0** **FA1** **10**

10% Moisture (**Step 2**)

Press Keys **FUNCT** **FA2** **0000**

2.6 VOLTAGE OUTPUT (Continued).

Example: 10% Moisture (Step 2 Continued)

Enter - 25. This will provide a minus -25% of the output.

-25% X 16 mA = -4mA which is subtracted from the

4mA level creating a zero level.

Press Keys **-** **2** **5** **FA2-** **25**

Example: 30% Moisture (**Step 3**)

Press Keys **FUNCT** **FA3** **MMMM**

Enter the high moisture level that will provide the high voltage output.

Example: 30% Moisture

Press Keys **3** **30** **FA3** **30.00**

Step 4

Press Keys **FUNCT** **F42** **100.0**

Enter % of high moisture output.

Example: 100% will provide 100% X 16mA + 4mA = 20mA.

Important	*Step 4 may be adjusted to compensate for a non-linear output due to internal resistance of recorder or controller.*

OPTION 3: BLOWER

Important	*This function applies only to BSP-901 systems that have the optional OPTO-PORT assembly with air blast attachment*.

The OPTO-PORT BLOWER option is typically used to measure moisture in product that is free falling or pneumatically conveyed. This option is programmed in Seconds. The sampling time period is the number of seconds it takes for a sample to collect and cover the sensing quartz window of the OPTO PORT assembly. At the end of this period, a solid-state relay closure occurs for a duration of one (1) second. A moisture reading is taken just prior to relay activation.

Connection to the relay is made at J4 Pins 7 and 8. The relay closure is rated at 0.5 Amps 24 to 28VAC (See Drawing SK-0109).

Important	*The display and moisture output will not update during the sampling period.*

3.1 To activate this function, perform the following actions inside the BSP-901 Console:

1. Turn off Switch U23 - S2
2. Press Switch Sw2, Reset.

Press Keys **FUNCT** **6** **F6B** **BBB**

3.2 For a ten second-collection period**:**

Press Keys **1** **0** **F6** **10**

An entry of "0 " will cause the relay to close every other second.

Maximum programmable value for BLOWER is 60 seconds.

OPTION 4: SECURITY LOCKOUT

The SECURITY option does not make the system absolutely secure, but it prevents idle curiosity or accidental keystrokes from changing the active calibration table or programmed entries.

A security code of " 1 2 3 4" is a factory set, fixed code to which the BSP-901 will always respond. You can enter your own code and the system will respond to both your code and the fixed code.

4.1 Security lock is selected by performing the following actions inside the BSP-901 Console:

1. Turn off U23 - Sw4
2. Press Reset Switch

4.2 To Program the Security code:

Press Keys **FUNCT** **8** **FUNCT** **F8P** **XXX**

Initially, "XXXX " may be any number, or 1 2 3 4 which is set at the factory. The **P** in the display means to program entry.

4.3 To enter your Security code for example 9876 :

Press Keys **9** **8** **7** **6** **F8P** **9876**

Press Key **FUNCT**

Your security code is now programmed into the BSP-901. It will become active **45 seconds** from the time the last keystroke is pressed.

4.4 After the 45 second period from the last keystroke, you will not be able to input data into the BSP-901 system.

To change parameters, you must perform the following:

Press Keys **FUNCT** **8**

Enter your code or the fixed code:

Press Keys **9** **8** **7** **6** **F8P** **9876**

The system can now be programmed as desired.

Important

It's a good idea to write down your code down. If for any reason the BSP-901 does not respond to your code or to the fixed code, perform the following action inside the BSP-901 console:
Turn on U23 - Sw4, Press the Reset Switch.

OPTION 5: PID CONTROL

In this section. we'll discuss the six functions of PID Control:

1. Control Output F71
2. Set Point F72
3. Gain F73
4. Integral F74
5. Derivative F75
6. Initial Control F76

5.1 Control Output - F71

Control output is an observable value in percent of full scale. This number tracks the 4 to 20 milliampere output. A control output of 100 percent corresponds to 20 milliamperes. The output relationship is linear between these two points.

Important *F71 is observable only; not programmable. See PID control, paragraph 5.6, Initial Control, F76.*

5.2 Set Point - F72

The control set point is programmable in terms of percent moisture. It is the desired value of the process variable. The set point is used in the controller to determine the output.

5.3 Gain - F73

Controller gain can be described by the following example:
A gain of one (1) and a moisture error of one (1) will cause a one (1) percent of full scale change in the controller output.

5.4 Integral - F74

The integral constant term TI (also called Reset), is programmed in units of minutes and provides control with zero error. This term occurs in the denominator of one term of the control equation illustrated below:

Control Output = Initial output + Gain (Error $+1/_{T1} \int_0^t$..error dt)

The larger the integral coefficient, the slower the response of the controllers.

For a gain of one (1) and $T_I = 1$, the integral will contribute a one (1) percent change in control output if the error is one for one minute. Setting the integral time to zero eliminates this term from the equation.

OPTION 5: PID CONTROL (Continued)

5.5 Derivative - F75

The derivative control term T_D (also called Rate) is programmed in units of minutes. This term is in the numerator and it provides output change as a function at the change in moisture error, that is, a large change in error will cause a large change in the controller output only as long as the error is changing. If the change in error is zero, then the contribution from the term is zero. The total control equation with both integral and derivative terms is therefore:

$$\text{Control Output} = \text{Initial Output} + \text{Gain}\left(\text{Error} + 1/T_1 \int_o^t \text{Error}\, dt + T_D(\text{Error})/dt\right).$$

The derivative term is sensitive to noise in the system (i.e. small changes in error about a nominal value) and therefore should be small (less than integral time).

5.6 Initial Control Value - F76

Initial control value is programmed in terms of percent of full scale. The value is the starting point when control is shifted from manual to automatic or automatic to manual. This value is also the output value for manual control. The initial control output can increment or decrement the 4 to 20 milliampere output in the manual mode (not control).

Control can be incremented by pressing the **1** key, and decremented by pressing the **0** key in manual mode. This gives a bumpless transfer when switching from manual to automatic.

5.7 ACTIVATING PID CONTROL

1. Turn off U-23 SW-1
2. Press Reset

5.8 ACTIVATE PID CONTROL WITH SAMPLE ON COMMAND.

1. Turn off U-23 SW-1
2. Turn off U-23 SW-3
3. Turn off U-23 SW-5
4. Press Reset

The sample on command with PID control will allow the PID control to toggle from automatic to manual and vice versa from a remote switch through a power source. (See the Sample On Command section).

OTHER PID CONTROL FEATURES

1. THE BSP-901 may be changed from automatic control to manual control and manual control to automatic control by pressing the **-** (minus) key when viewing **F71** or Moisture A1, A2, A3, A4, or A5

In the automatic PID control mode , a "C" will appear in the display.
Example:
In the Manual mode the display reads **A1** **10.7**
For the Automatic mode:
Press Key **-** **A1C** **10.7**

In the Manual mode the display reads **F7** **20**
For the Automatic mode:
Press Key **-** **F7C** **20**

For remote PID switching see the Sample on Command with PID Section 1.3

2. OUTPUT RANGE LIMITS (PID CONTROLLER OPTION)

The output scaling table has a different function for the controller option. By programming FM 1 and FM2 to the same minimum output such as 5 percent, the scaling table limits the Output Range to that percentage.

Likewise, if FM3 and FM4 are programmed with the same maximum output such as 80 percent, the Output Range will be limited to that percentage.

For Example:

If FM1 and FM2	= 5	then the low output is limited to 5% of 16mA = 4mA + .8mA = 4.8mA.
If FM3 and FM4	= 80	Then the high output is limited to 80% of 16mA = 12.8mA +4mA = 16.80mA.

3. LOSS OF PRODUCT ALARM

When in the PID Control and an absence of product causes a LOP alarm condition, the control (4-20mA) current output signal is held at the value when the LOP condition occurred. When product is again available and the LOP alarm condition is canceled, the automatic control function remains enable with no upset in control output signal.

VIEWING SENSOR SIGNALS

The final keyboard function is viewing the DARK, A, B signals by pressing

FUNCT **9** **n** where **n** is from **0** to **2**.

Pressing **FUNCT** Will cycle forward through the functions.

The values are updated every 5/7 seconds on the display. No smoothing is done on the data, although each data actually is an average of four sensor readings.

The only way to exit this function is to press **CALIB** or **MOIST**

The Dark signal is displayed as **F90** **nnn** Where the nnn is a decimal value for the A/D converter output

The A signal is displayed as **F91** **nnn**

The B signal is displayed as **F92** **nnn**

4095 is the maximum decimal number allowed and represents SIGNAL SATURATION. Lower the gain to obtain proper Signal Levels if this reading should occur.

OTHER KEYS

The key **PREV** causes certain functions to reverse to the previous function or Data entry.

Example:

If your display reads **FA4** **XXXX**

and you want to reverse the function,

Press Keys **PREV** **FA3** **XXXX**

DISABLING THE AUTOMATIC GAIN SYSTEM ON AR-901 UNITS.

The BSP-901 AUTO-RANGING Moisture Measurement System can be modified using a jumper, to operate without the Automatic Gain System functioning. For applications where the product comes under the Sensor in an intermittent fashion, it is desirable that the Sensor acquire the product as soon as possible, and hold the reading immediately after the product passes. When the Loss of Product Alarm function is to be used as a Sample Hold, the Automatic Gain System causes un-necessary delays in acquiring a stable reading of the product.

During start-up or calibration, Automatic Gain should be enabled to automatically select the correct gain for the reflectivity level of the product. When intermittent products are run, the Automatic Gain is disabled. Auto Gain can be enabled or disabled by removing or inserting a jumper block in theAR901 Power Box Assembly. With Auto Gain enabled, the System works normally with the full gain range of the System available automatically.

With the Auto Gain disabled, when the product is removed from the Sensor’s view, the LOP alarm is immediately triggered, holding the last reading on the product. When new product comes into view, the LOP alarm is turned off, allowing update of the display with data that represents the new product.

Depending upon the conveying line speed, there may be an erratic reading for a very short time (35 ms.) when the edge of the product is read by the Sensor. By programming a modest amount of smoothing, an accurate read-out of the product moisture content will result.

ENABLING / DISABLING AUTOMATIC GAIN

This feature is accessed with jumper block header JP3 on the circuit board in the AR901 Power Box.

To **disable** Automatic Gain, insert a jumper block in JP3 header.

To **enable** Automatic Gain, remove the jumper block from JP3 and store it on JP1 header.

SETTING LOSS OF PRODUCT (LOP) LEVELS

When Automatic Gain System is enabled (no JP3), the System adjusts the gain level to keep the two LOP levels between 2000 and 3000. When Automatic Gain is disabled (JP3 in place), the LOP level will vary with moisture content and

product presentation to the Sensor. If the Sensor field of view is empty, the LOP level will drop considerably, and without Automatic Gain Control, will drop near zero.

A good Low LOP Alarm Level to choose when using the System with the Auto Gain disabled is about ½ of the product LOP levels, or between 1000 and 1500.

It is important to be sure that when there is no product in the Sensor field of view, the LOP level drops significantly. This will be a function of the conveying system. A rubber belt that is black will normally give a low LOP level with Auto Gain disabled. If it is shiny however, there will be a direct reflection back into the Sensor that will provide a false LOP signal level. The Sensor can be tilted about 15 deg. from vertical to eliminate any direct reflection problems.

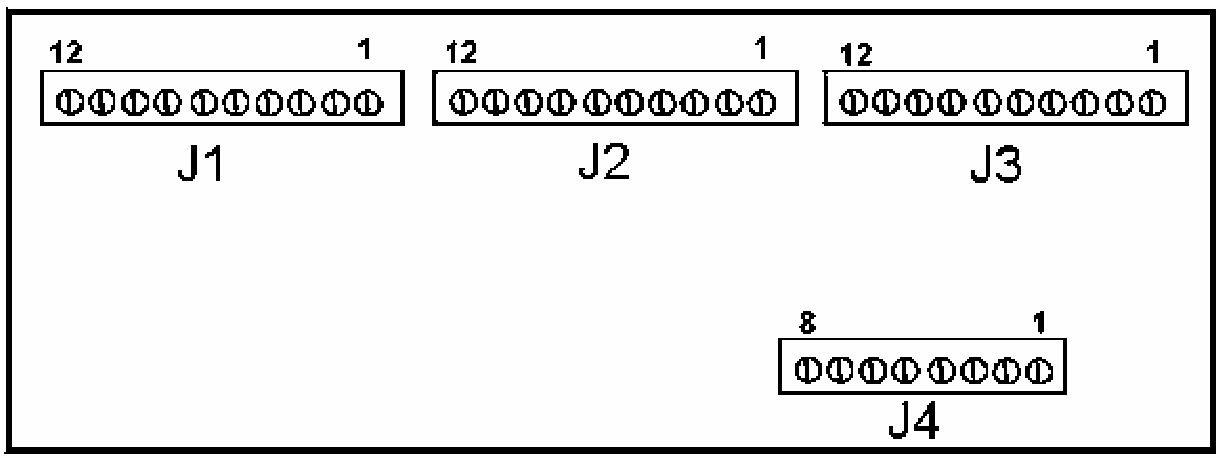
A roller conveyor is normally mounted a few feet off the floor, and this configuration will give a low LOP level with no product. Be sure that the Sensor is not illuminating a frame member of the conveyor and getting a false LOP signal.

A shiny metal screen conveyor will often give a high LOP level that is above 3000. The LOP function will also operate at a high level. Program a High LOP level that is half way between the 3000 operating level and 4095 (the LOP limiting value) or about 3500.

The LOP Alarm Levels are programmed using the F,3 keys. See Function 2, Loss of Product Alarm Levels.

APPENDIX A

USER CONNECTIONS TO THE BSP-901 SYSTEM



1. Connect 120VAC power to J3:

			AC CORD:
J3-6	120VAC	HOT	(BLACK wire)
J3-12	120VAC	NEUTRAL	(WHITE wire)
J3-10	CHASSIS GROUND		(GREEN wire)

Route the power cord through the middle cable grip.

---

2. Connect remote (Sample on Command) /(Auto/Manual) 24VAC/DC input to J2-5 and J2-6, if required.
   For DC power:
   Connect plus (-) side of DC input to J2-5
   Connect plus (+) side of DC input to J2-6

---

3. Connect the 4-20mA Proportional or Control Output to J1 :
   J1-6 4-20mA Output + (plus).
   J1-2 4-20 mA Output Return (-) minus.
   Maximum load not to exceed 250 Ω (ohms).
   Route these wires/cables through the lowest cable grip.

USER CONNECTIONS TO THE BSP-901 SYSTEM (Continued)

4. Connect the 8 conductor NIR/RF cable (shipped with system) to **J1** and route through the upper cable grip.

(SOLDER THE STRANDED ENDS TO AVOID SHORTS)

BROWN	wire to J1-11	(Moisture Signal)
YELLOW	wire to J1-1	(Analog Ground)
GREEN	wire to J1-5	(-15V DC)
RED	wire to J1-7	(+15V DC)
WHITE or VIOLET	wire to J1-9	(+5V DC SYNC) White used on older systems
BLUE	wire to J1-4	(SYNC GROUND)
ORANGE	wire to J1-12	(SYNC)
BLACK	wire : cut short and float	
SHIELD	wire : cut short and float	

---

5. Solid State Relay Outputs Terminals:

HIGH	Moisture Alarm	J4 pins	3 & 4
LOW	Moisture Alarm	J4 pins	5 & 6
BLOWER		J4 pins	7 & 8
LOSS OF PRODUCT ALARM		J4 pins	1 & 2

Route these wires/cables through lowest cable grip.
All the Solid State Relays rated at 0.5 Amps 24 to 28VAC.

APPENDIX B

QUICK REFERENCE CHART

BSP – 901 FUNCTIONS

Function	Key	Display Left	Right	
Calibration Signal	C	C	CCCC	
Loss of Product Signal	F,2	F2 L	LLL	
Dark Signal	F,9,0	F90	DDD	
A Signal	F,9,1	F91	AAAA	
B Signal	F,9,2	F92	BBBB	
Select Moisture Table	M,1-5	AX	MMMM	%
Zero Offset Tables	F,4,1-5	F41	ZZZ	%
Smoothing Coefficient	F1	F1	SSS	RDGS.
Loss of Product Alarm Level	F,3	F3 L	LLL	
Blower Sample Period	F,6	F6 B	BBB	SEC
High/Low Moisture Alarm				
High Moisture Alarm	F,5	FS H	HHH	%
Low Moisture Alarm	F	F5L	LLL	%
Calibration Table				
Low Cal Value	F,C,1-5	FCX1	CCCC	
% Moisture For Low Cal Value	,F	FCX2	LLLL	%
Med/High Cal Value	,F	FCX3	CCCC	
% Moisture For Med/HI Cal Value	,F	FCX4	MMMM	%
High Cal Value or 9999	,F	FCX5	CCCC	
% Moisture For Hi-Value or 9999	,F	FCX6	HHHH	%
Output Scaling Table				
Lower % Moisture Value	F,M	FA1	MMMM	%
Lower % of Output Limit	,F	FA2	OOOO	%
Upper % Moisture Value	,F	FA3	MMMM	%
Upper % of Output Limit	,F	FA4	OOOO	%
PID Control Table				
Control Output	F7	F71	OOO	%
Set Point	,F	F72	SSS	%
Gain	,F	F73	GGGG	
Integral	,F	F74	I I I I	MIN
Derivative	,F	F75	DDDD	MIN
Initial Control	,F	F76	I I I	%

APPENDIX C
BSP – 901 QUICK REFERENCE FORM

PRODUCT DESCRIPTION ______________________________

LOSS OF PRODUCT SIGNAL (BETWEEN 600 AND 2500) F,2 ______________

DARK SIGNAL (GREATER THAN 200) F,9,0 ______________________

A SIGNAL F,9,1 ______________________________

B SIGNAL F,9,2 ______________________________

CALIBRATION TABLE (F,C,1 FOR TABLE ONE)

LOW SAMPLE CAL VALUE F,C,1,1 ______________________

LOW SAMPLE % MOSITURE F,C,1,2 ______________________

MED/HIGH SAMPLE CAL VALUE F,C,1,3 ______________________

MED/HIGH SAMPLE % MOISTURE F,C,1,4 ______________________

HIGH SAMPLE CAL OR 9999 F,C,1,5 ______________________

HIGH SAMPLE % MOISTURE F,C,1,6 ______________________

ALARMS

HIGH MOISTURE ALARM F,5 ______________________

LOW MOISTURE ALARM F,5,F ______________________

LOSS OF PRODUCT LEVEL F,3 ______________________

LIST OF DRAWINGS

551770 – 1	NIR CALIBRATION TEST PLATE USER INSTRUCTIONS
552700	NIR & SMART II SENSOR ASSEMBLY DWG.
552240-9	SAMPLE-ON-COMMAND, BSP – 901 (USER'S WIRING DIAGRAM
MRC003842	NIR HEAD (INSTALLATION DRAWING)
551695	CABLE ASSEMBLY, 15 CONDUCTOR, IR1/1A HEAD TO POWER SUPPLY, 17 PIN
551698	CABLE ASSEMBLY, 8 CONDUCTOR, IR/RF SENSOR TO BSP-901
552448	CABLE ASSEMBLY, MALE – FEMALE, 6 COND. SMT2UL
552524	901 AUTORANGE BOX ASSEMBLY
552533	AR901 PROCESSOR BOX ASSEMBLY (SCHEMATIC DIAGRAM)
552278	DUST SHEILD INSTALLATION INSTRUCTIONS
551929	DUST SHEILD SENSOR ASSEMBLY (INSTALLATION DIMENSIONS)
REMOPER.DOC	BSP-901 REMOTE OPERATOR BOARD ADD-ON
552168	BSP-901 REMOTE OPERATOR RS-232 CABLE WIRING DIAGRAM FOR CONNECTION TO PC TYPE COMPUTER
OPTOPORT.DOC	OPTO-PORT ATTACHMENT
SK0109	BSP 901 BLOWER CONNECTION
551151	IR SENSOR W/OPTOPORT (INSTALLATION DRAWING)

NIR CALIBRATION TEST PLATE USER INSTRUCTIONS

DRAWING NO. 551770-1, FILE NO. IRSTDIN.DOC
RELEASE, DATED JANUARY 22, 1999 per EO 31867

1. INTRODUCTION

Near Infra-Red (NIR) Measurement Calibration Test Plates have been developed which allow operational verification of the N.I.R. Moisture Measurement Systems using SMART II Sensors.

The NIR Calibration Test Plate (P/N 5511769) consists of a white ceramic disk covered with a Pyrex glass disk. These elements are cemented into a black anodized aluminum holder.

When the Calibration Test Plate is attached to the IR Sensor, a repeatable Calibration Signal (C.S.), Moisture Signal (M.S.) and Loss of Product (L.O.P.) Signal is generated. This allows operational verification of all aspects of the system.

2. DIRECTIONS FOR USE

Be sure that the glass surface of the Calibration Check Fixture is clean and free from fingerprints and dust. Clean with a soft cloth if necessary.

Slide the mounting ring of the Calibration Test Plate onto the Lamp Housing of the Sensor and tighten the nylon screw to hold it in place. Center the image of the lamp filament on the Calibration Test Plate glass surface by moving the Calibration Test Plate on the Lamp housing. For best accuracy, the System should have been running for about 30 minutes prior to checking with the Calibration Test Plate.

For the SMART II NIR Systems the Loss of Product signal (L.O.P.) value should be approximately 3000. The L.O.P. will alternately show values on either side of 3000. Record the L.O.P. value.

Read and record the Calibration Signal and also the Moisture Signal with the Calibration Test Plate in place. The readings of L.O.P. and C.S. obtained should be within only a few counts of the same readings obtained the last time the Calibration Test Plate was used. The Moisture Signal reading will depend upon the values entered in the Calibration Table for the product being measured.

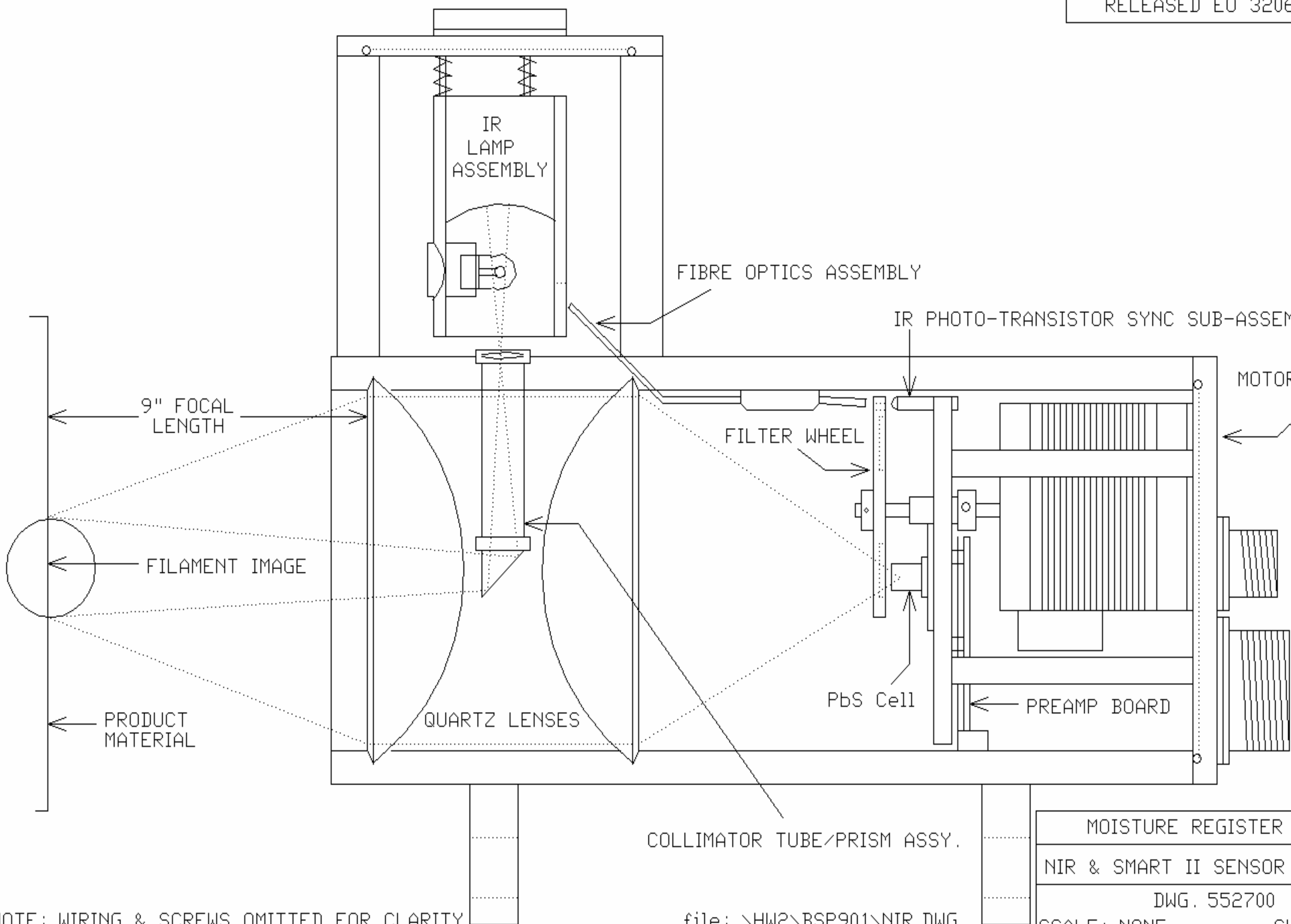
If difficulties have been encountered in correlating laboratory moisture measurements with the System moisture measurement, the Calibration Test Plate will help to determine if there has been any failure in a System component. A failure in the detector cell cooling, lamp voltage regulator or excess air temperatures around the Sensor will show up as a long term C.S. drift which is related to temperature. If C.S. and L.O.P. are correct, but M.S. is not correct, it is possible that an incorrect Calibration Table has been selected.

Note: Store the Calibration Test Plate in a clean, dry location.

3.0 CALIBRATION TEST PLATE VERIFICATION TABLE

DATE OF CALIBRATION TEST PLATE VERIFICATION:			
Product Calibration Signal			
Product Loss-of-Product Signal			
Product Moisture Reading			
Calibration Signal with Test Plate			
Loss-of-Product Signal with Test Plate			
Moisture Reading with the Test Plate (Based on the Calibration table used)			

RELEASED EO 32065 | 8-02



MOISTURE REGISTER PRODUCTS

NIR & SMART II SENSOR ASSEMBLY

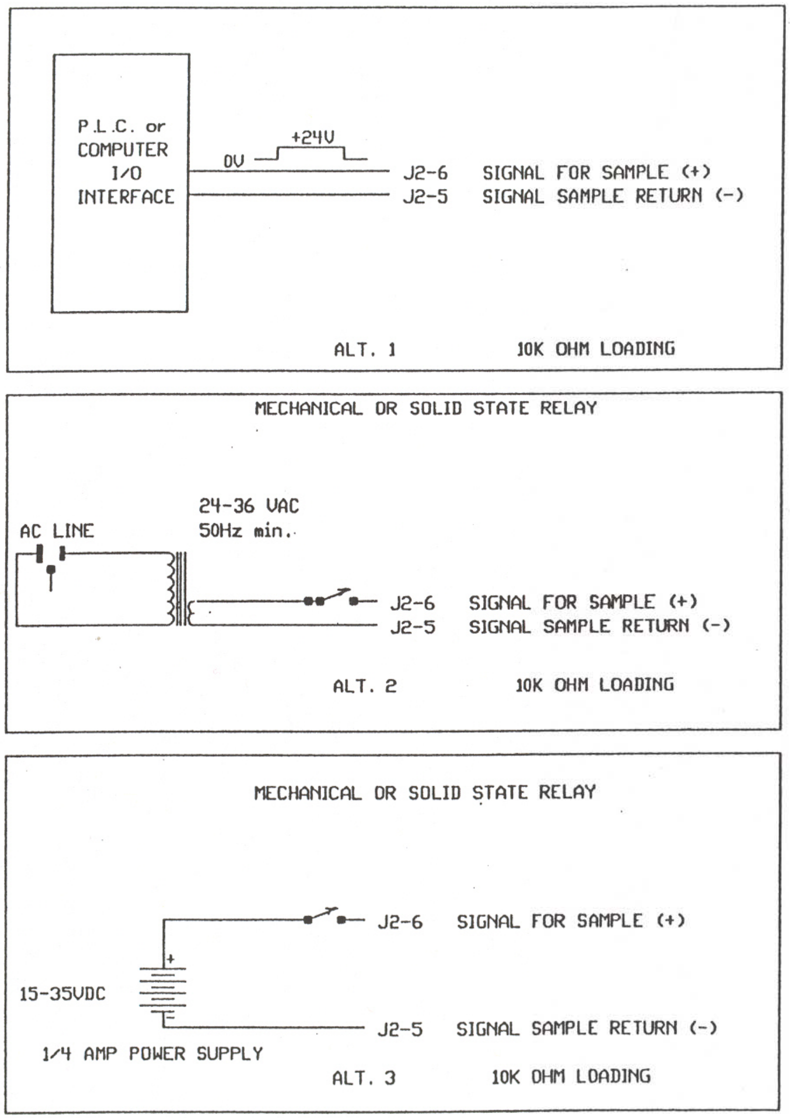
DWG. 552700

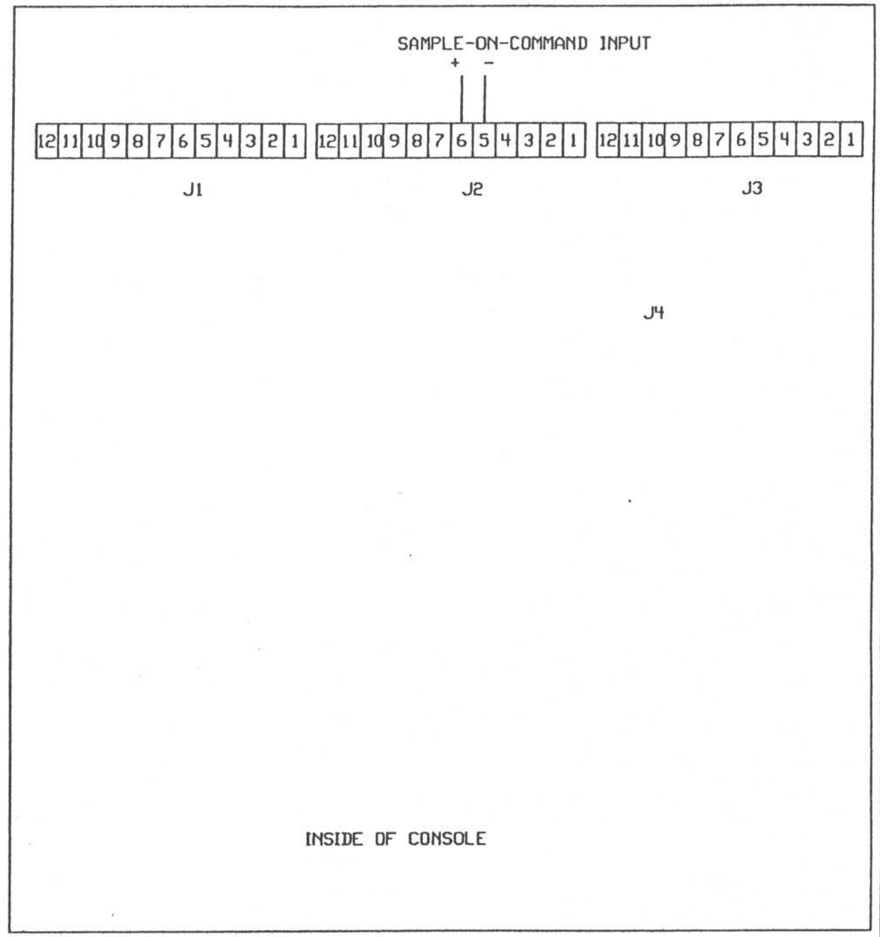
SCALE: NONE SHEET 1 of 1

NOTE: WIRING & SCREWS OMITTED FOR CLARITY

file: \HW2\BSP901\NIR.DWG

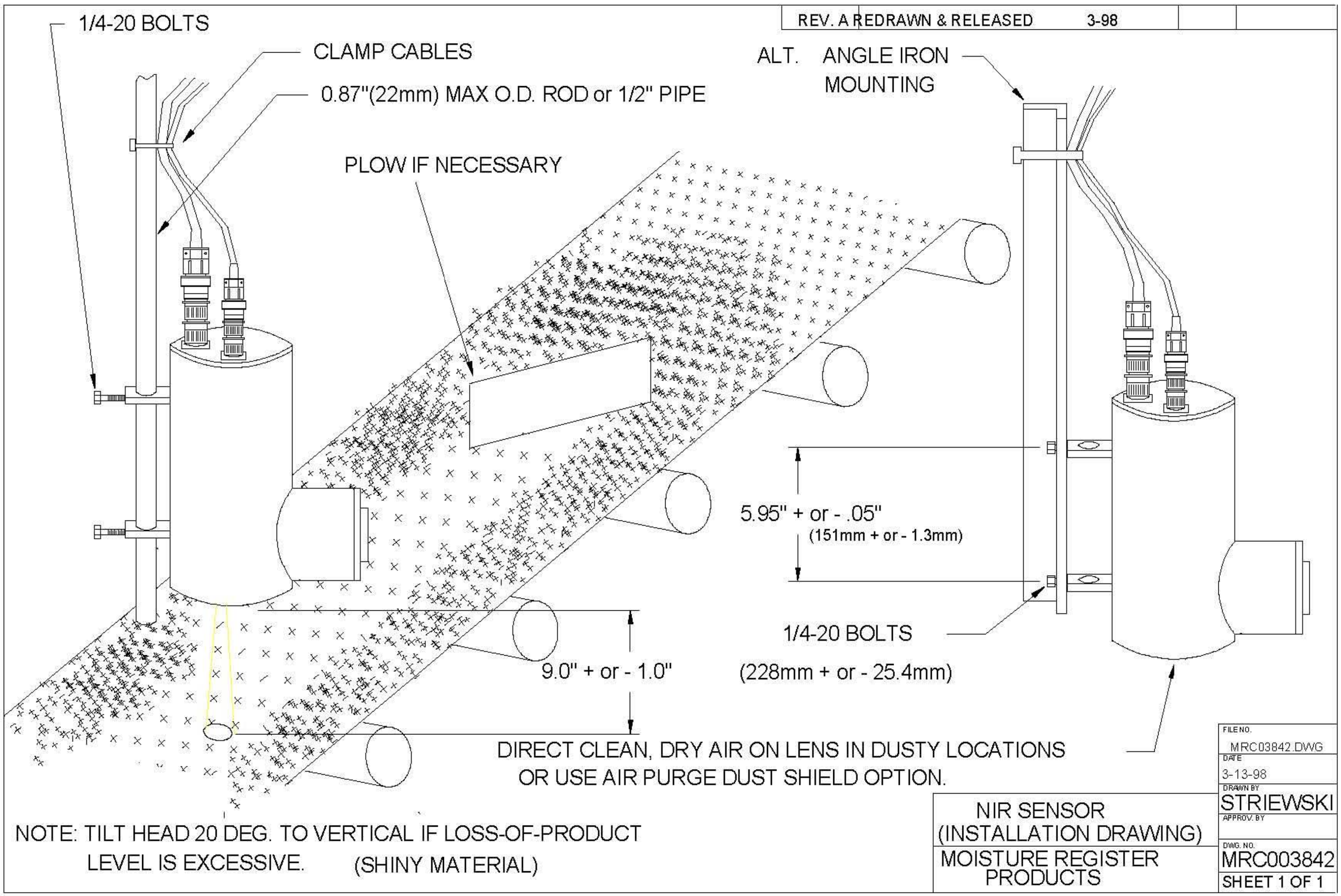
SUGGESTED SIGNAL SOURCES:





		MOISTURE REGISTER PRODUCTS	
prepared	5-16-95	SAMPLE-ON COMMAND, BSP-901 (USER'S WIRING DIAGRAM)	
checked			
engineer	RS		
FILE: 552240-9		size / code id no.	drawing no. 552240-9
SOC		scale	sheet 1 of 1

NOTE: USE #16 TO #24 AWG WIRE UP TO 2000 FT.


REV. A REDRAWN & RELEASED 3-98
1/4-20 BOLTS
CLAMP CABLES
0.87"(22mm) MAX O.D. ROD or 1/2" PIPE
ALT. ANGLE IRON MOUNTING
PLOW IF NECESSARY
5.95" + or - .05"
(151mm + or - 1.3mm)
1/4-20 BOLTS
(228mm + or - 25.4mm)
9.0" + or - 1.0"
DIRECT CLEAN, DRY AIR ON LENS IN DUSTY LOCATIONS
OR USE AIR PURGE DUST SHIELD OPTION.
NOTE: TILT HEAD 20 DEG. TO VERTICAL IF LOSS-OF-PRODUCT
LEVEL IS EXCESSIVE. (SHINY MATERIAL)
NIR SENSOR
(INSTALLATION DRAWING)
MOISTURE REGISTER PRODUCTS
FILE NO. MRC03842.DWG
DATE 3-13-98
DRAWN BY STRIEWSKI
APPROV. BY
DWG. NO. MRC003842
SHEET 1 OF 1

REVISIONS

REV.	DESCRIPTION	DATE	APPROVED
A	Release per E.O. 31257	10-9-86	RS
B	Revised per EO 31367	11-21-90	RS
C	Revised per EO 31388	4-8-91	RS
D	REVISED PER EO 31416	9-13-91	RS
E	Revised EO 31421	10-28-91	RS
F	Revised EO 31552	4-28-95	RS
G	EO 31637 BoM Desc.	6-96	RS
H	EO 31643 ⏚ rm	6-21-96	RS
I	EO 31768 CLARIFY PIN CIRCLE	11-97	RS
J	EO31870 CLARIFY SEAL	2-99	RS
K	EO 31950 JPRs to Shld.	8-01	RS
L	EO 32036 + NYL. WHRS	5-02	RS
M	EO 32129 +TRIPLE BRAID	4-03	RS

NEXT ASSY	USED ON
SMART.....	SMART IR1A
BSP901.....	IR1A BSP901
MRC 6520/1	BSP4004

APPLICATION

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:
FRACTIONS ±1/64 DECIMALS .XX ±.030 .XXX ±.010 ANGLES ±0° 30'

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

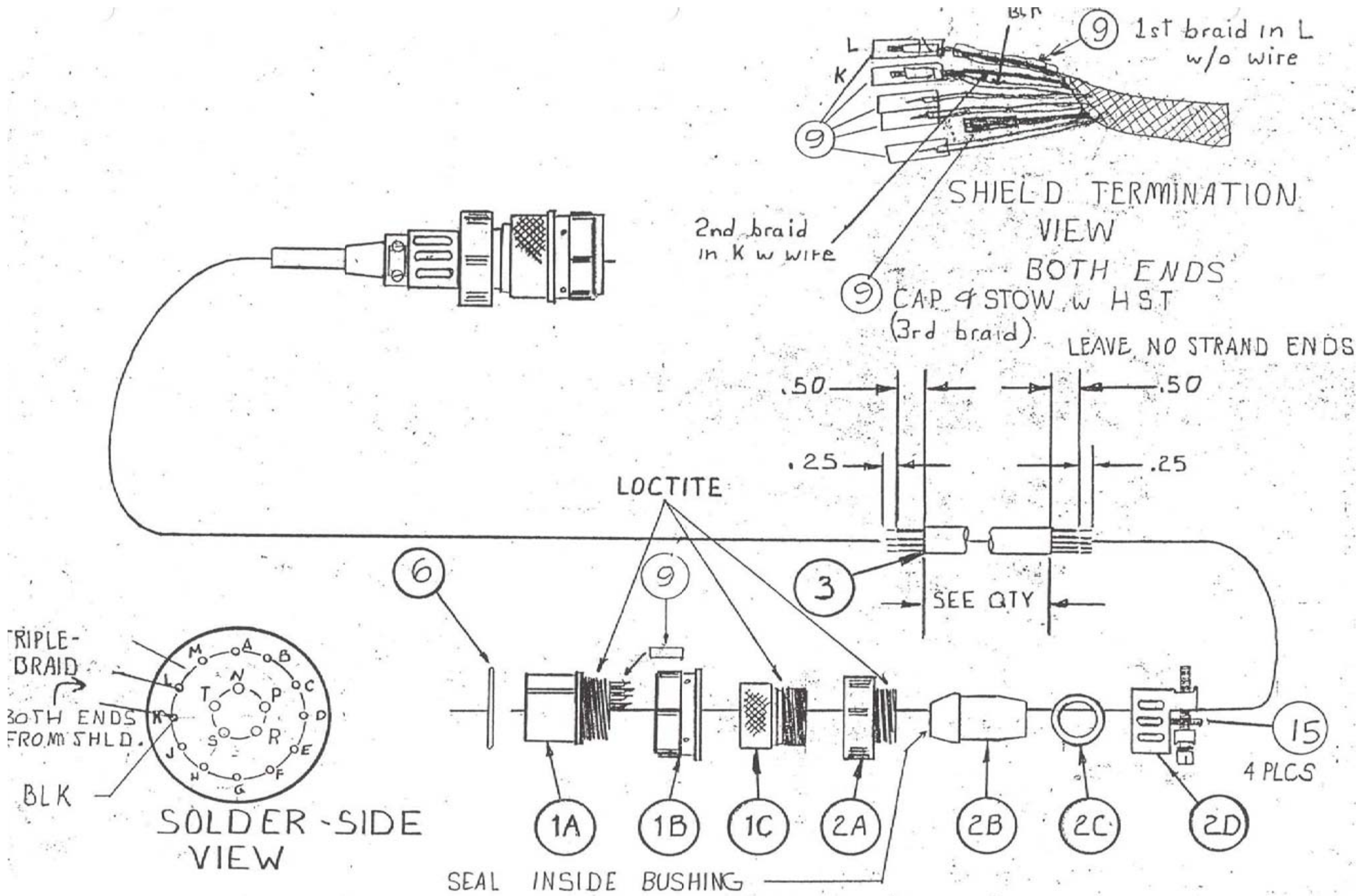
APPROVALS		DATE
DRAWN	Roger S.	9/23/86
CHECKED	RS	10-9
APPR	Roger Stasinski	10-9-86
APPR		

[redacted] M. R. P.

CABLE ASSEMBLY, 15 CONDUCTOR, IR1/1A HEAD TO POWER SUPPLY, 17 PIN

SIZE	FSCM NO.	DWG. NO.	REV.
A	14506	551695	A

SCALE | SHEET 1 of 4



CODE IDENT NO	SIZE	
14506	A	551695
SCALE ~		SHEET 2 OF 4

	FROM			TO						
LINE	COMP NO.	ROW NO.	PIN NO.	COMP NO.	ROW NO.	PIN NO.	WIRE SIZE	WIRE COLOR	SIGNAL	REMARKS
			A			A		BRN		BOTH ENDS
			B			B		RED		
			C			C		ORG		
			D			D		YEL		
			E			E		GRN		
			F			F		BLU		
			G			G		VIO		
			H			H		GRY		
			J			J		WHT		
			T			T		W/BRN		
			M			M		W/RED		
			N			N		W/ORG		
			P			P		W/YEL		
			R			R		W/BLK		
			K			K		BLK	COOLR RTN.	
			K			K	2ND	BRAID	COOLR RTN.	
			L			L	1ST	BRAID	SHIELD	
			FLOAT			FLOAT	3RD	BRAID	SHIELD	CAP & STOW END W/HST.

WIRE / CABLE LIST FILE 551695WL	SIZE	IR 17-PIN CABLES WIRE LIST
	551695	SHEET 3

REVISIONS

REV.	DESCRIPTION	DATE	APPROVED
A	RELEASE PER E.O. 31257.	10-9-86	RS
B	REVISED PER EO 31367	11-21-90	RS
C	REVISED EO 31415	9-12-91	RS
D	EO 31616 Lengths	4-11-96	RS
E	EO 31692 Sleeve Details	10-96	RS
F	EO 31870 CLARIFY SEALS	2-99	RS

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QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

NEXT ASSY	USED ON
551496	IR Long Cable
551679	IR1A
MRC 6240	IR1
	RF

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:
FRACTIONS ±1/64 DECIMALS .XX ±.030 .XXX ±.010 ANGLES ±0° 30'

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

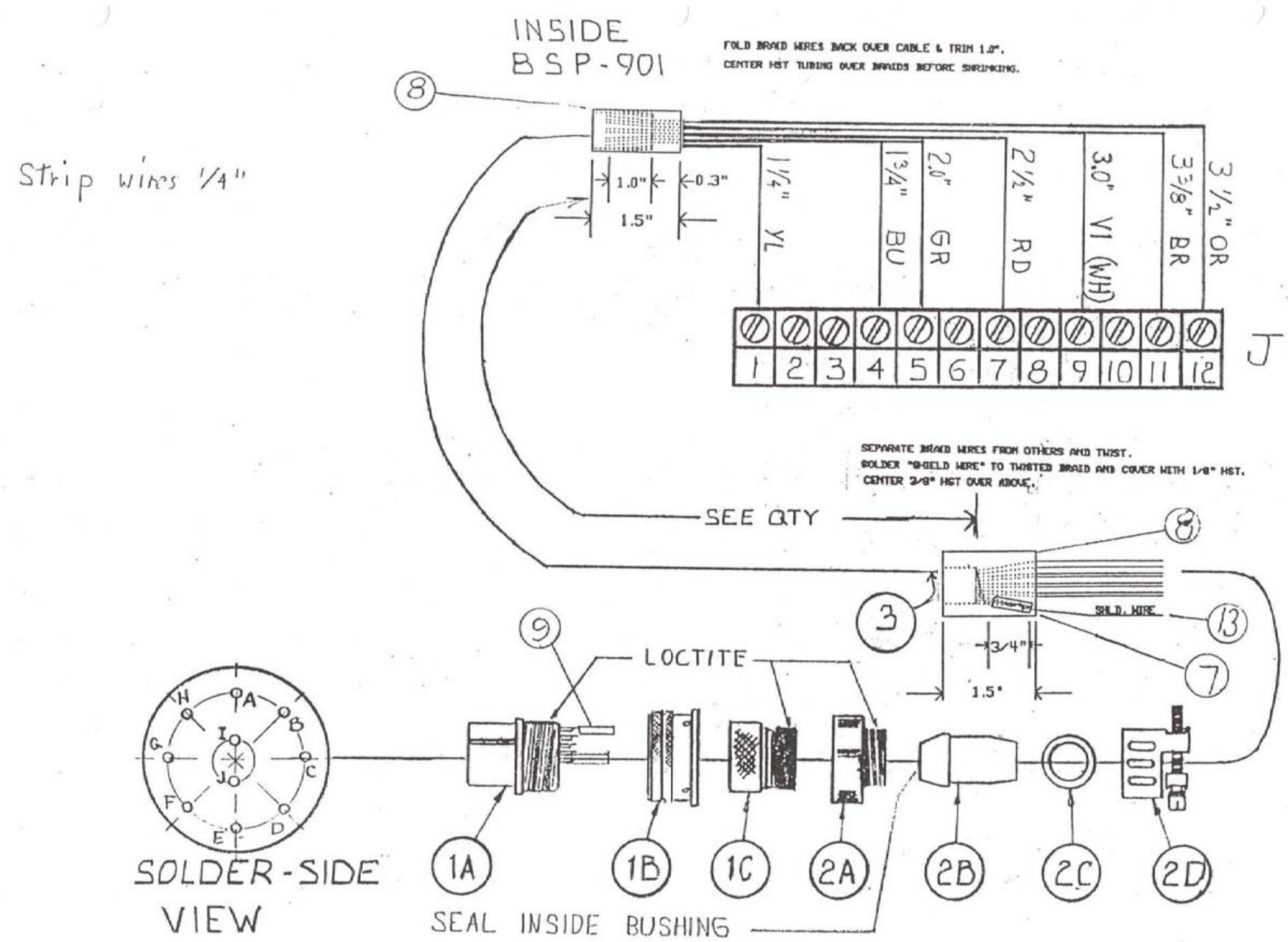
APPROVALS		DATE
DRAWN	Roger S.	9/23/86
CHECKED	RS	10-9
APPR	Roger Strawinski	10-9-86
APPR		

[redacted] M. R. P.

CABLE ASSEMBLY, 8 CONDUCTOR,
IR/RF SENSOR TO BSP-901

SIZE	FSCM NO.	DWG. NO.	REV.
A	14506	551698	F

SCALE | SHEET 1 of 4



CODE IDENT NO	SIZE	551698
14506	A	
SCALE ~		SHEET 2 OF 4

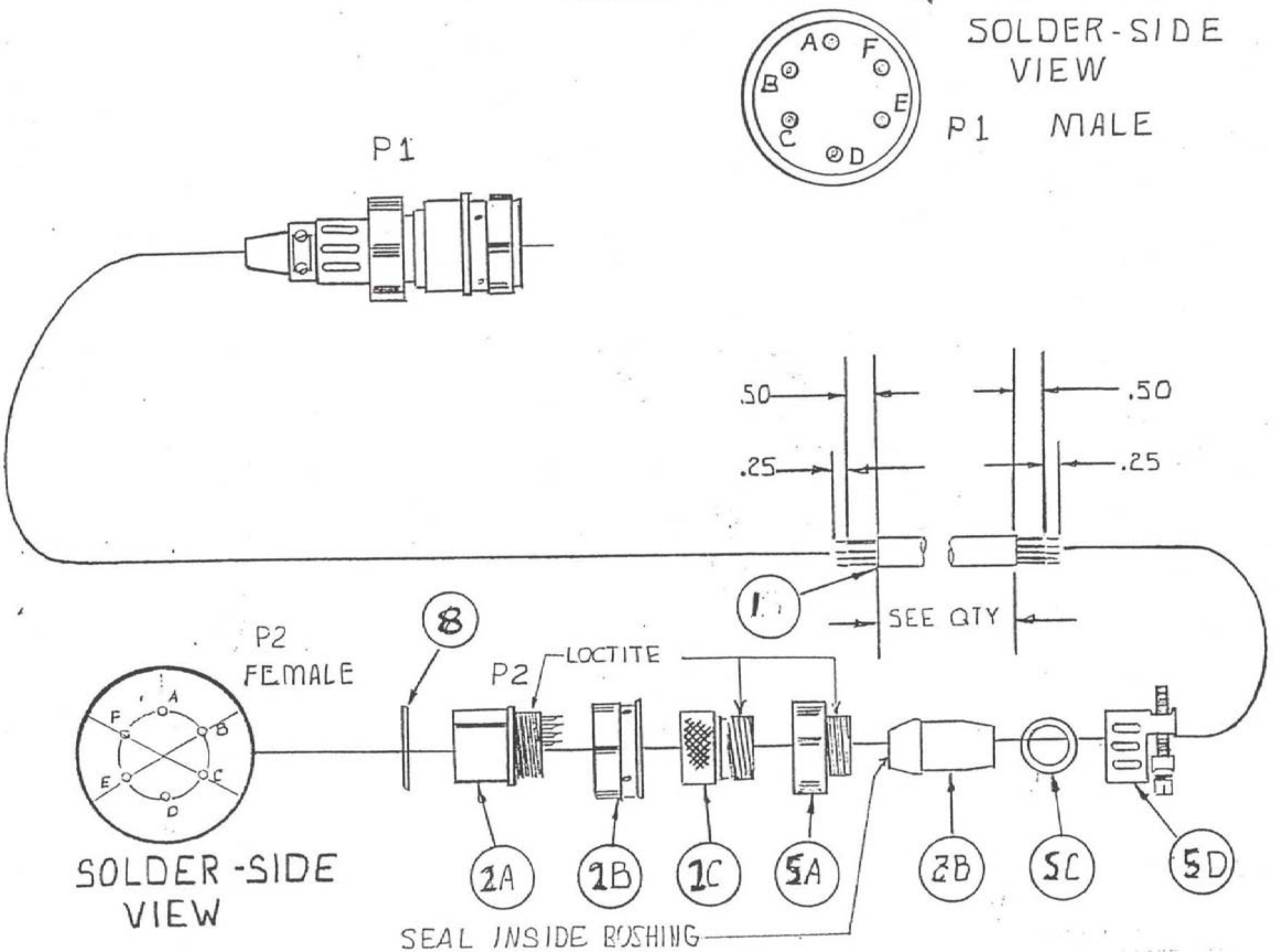
	FROM			TO						
LINE	COMP NO.	RO W NO.	PIN NO.	COMP NO.	RO W NO.	PIN NO.	WIRE SIZE	WIRE COLOR	SIGNAL	REMARKS
	53264 4	-002	A	ITEM 4		11		BRN	SENS	THREAD CABLE INTO BSP901
										CASE BEFORE TERMINATIN G
	53264 4	-002	B			1		YEL	A-GND	
	53264 4	-022	C			5		GRN	-15	
	53264 4	-022	D			7		RED	+15	
	53264 4	-002	E			9		WHT or VIO	+5 SYNC	
	53264 4	-002	F			4		BLU	SYNC GND	
	53264 4	-002	G			12		ORG	SYNC	
	53264 4	-002	H			FLOAT	20ga	SHIELD		SEE DRAWING
	53264 4	-002	J			FLOAT		BLK		CUT SHORT

WIRE / CABLE LIST	SIZE A	551698
		SHEET 3

	FROM			TO						
LINE	COMP NO.	RO W NO.	PIN NO.	COMP NO.	RO W NO.	PIN NO.	WIRE SIZE	WIRE COLO R	SIGNAL	REMARKS
	P1 MALE		A	P2 FEMALE		A	16	RED	+5V	NON-SHIELDED NATN'L
	P1 MALE		B	P2 FEMALE		B	16	ORG	117 VAC	STYLE 2464 CABLE
	P1 MALE		C	P2 FEMALE		C	16	YEL	GND	
	P1 MALE		D	P2 FEMALE		D	16	GRN	GND	
	P1 MALE		E	P2 FEMALE		E	16	BLK	117VAC	
	P1 MALE		F	P2 FEMALE		F	16	BRN	+5V	

RELEASED 1/99 REV. B E.O. 32058 PG.NOS. 7-02 WIRE / CABLE LIST	SIZE A	CABLE ASSY. MALE-FEMALE, 6 CD.SMT2UL
	552448	SHEET 1 OF 2

REV. B | E0 32058 Pg. Nos., P1 & P2 | 8-... | RS



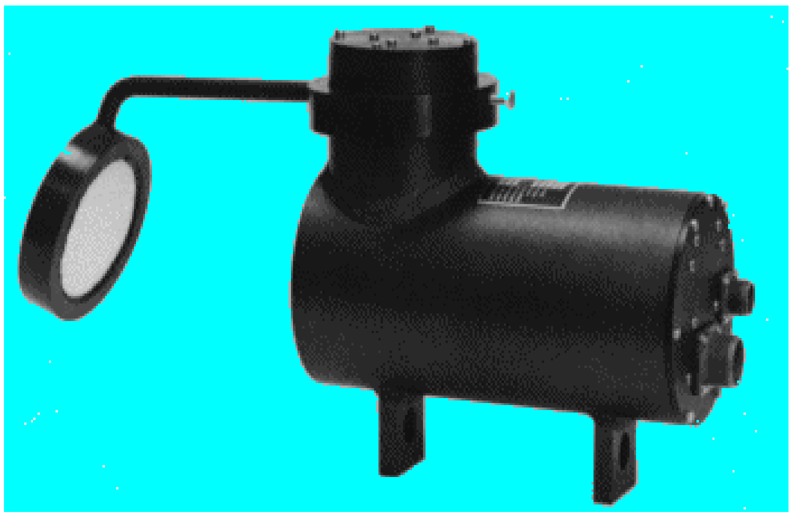
CODE IDENT NO	SIZE	
14506	A	552448
SCALE ~		SHEET 2 OF 2

SEE BOM for PARTS LIST

MOISTURE REGISTER PRODUCTS
A Division of Aqua Measure Instrument Co.

IR TEST PLATE

For IR-1A Sensors and IR-III Sensors



IR Test Plate attached to IR Sensor

The **IR Test Plate** is a quick and easy way to verify the results obtained by Moisture Register Products' IR-1A, IR-III and SMART-II Sensors. The **IR Test Plate** consists of a black anodized aluminum frame with a ceramic disk protected by a Pyrex glass. The **IR Test Plate** is attached to the Sensor's lamp housing so that the light image is centered on the glass disk. Your IR Sensor will now register a single, repeatable Calibration Signal, Moisture Signal, and Loss-of-Product Signal. This is your **IR Test Plate** reading. Take the **IR Test Plate** readings and record them in a log each day or as needed. If there is a need to check the system at any point you will be able to simply compare the current **IR Test Plate** reading against the recorded readings. Any system malfunction will show as a gross deviation in the **IR Test Plate** readings.

For the MCP-1, IR-III System, there are two IR Test Plates available. One is for white products and the other is for dark or black products.

MOISTURE REGISTER PRODUCTS
A DIVISION OF AQUA MEASURE INSTRUMENT CO.
P. O. Box 369 - 1712 Earhart Court. La Verne, CA 91750-0369
Phone: (909) 392-5833 - Toll Free: (800) 9-MOISTURE
Fax: (909) 392-5838 - e-mail: aquamoist@aol.com
Web Page: http://members.aol.com/aquamoist

Represented By:

REV.	DESCRIPTION	DATE/APPRVL.
	RELEASE	4-01

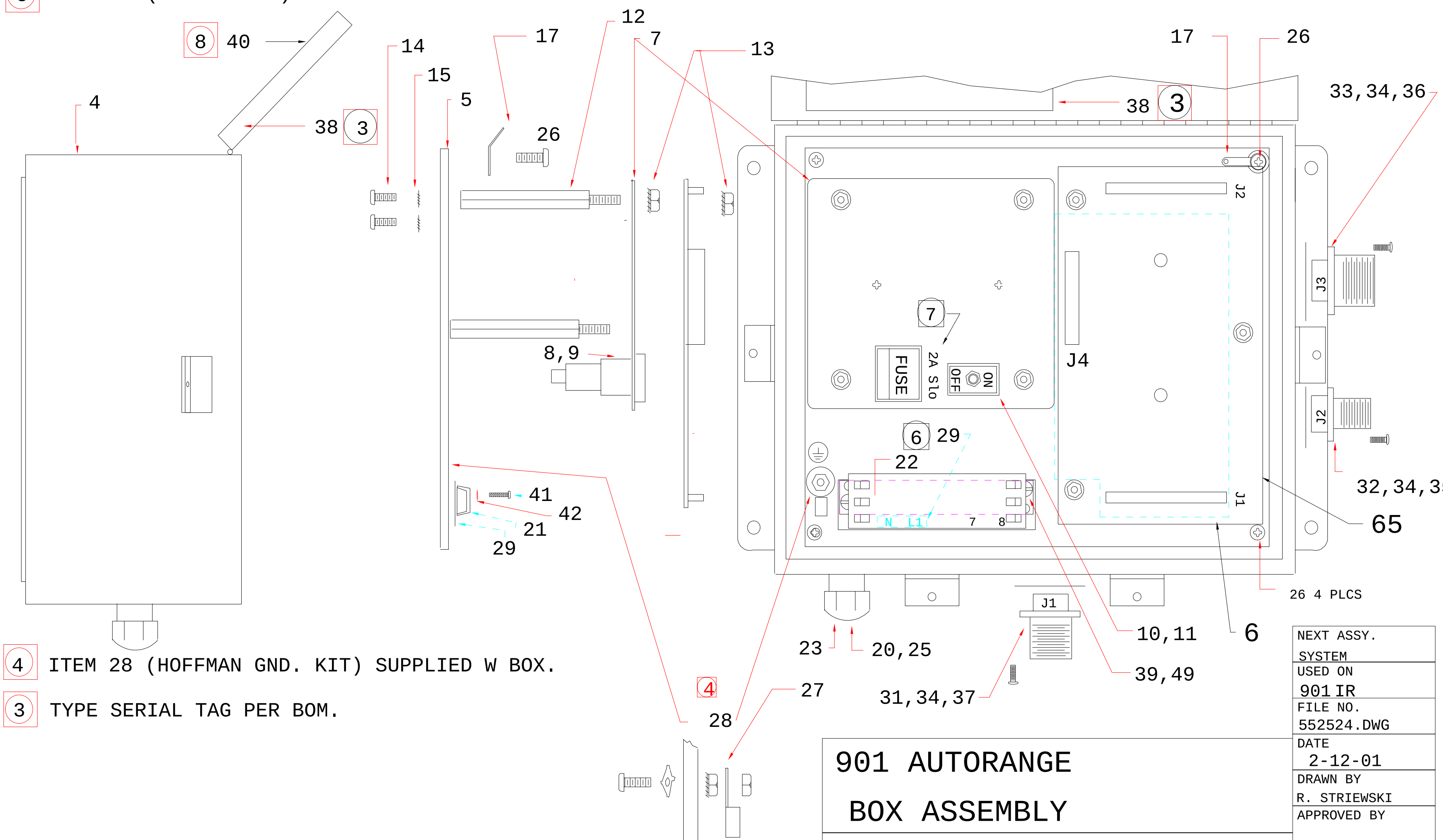
9. NOT ALL STANDOFFS, HARDWARE SHOWN FOR CLARITY

(8) SEE DWG 552271

(7) HAND STAMP 2A Slo PER DWG. 552272.

(6) STAMP TB1 STRIP PER DWG. 552273. -2

(5) ITEM 26 (#10 SCREWS) SUPPLIED W BOX.



(4) ITEM 28 (HOFFMAN GND. KIT) SUPPLIED W BOX.

(3) TYPE SERIAL TAG PER BOM.

(1) CEMENT BOTTOM OF STANDOFF W LOCTITE OR EQUIV.

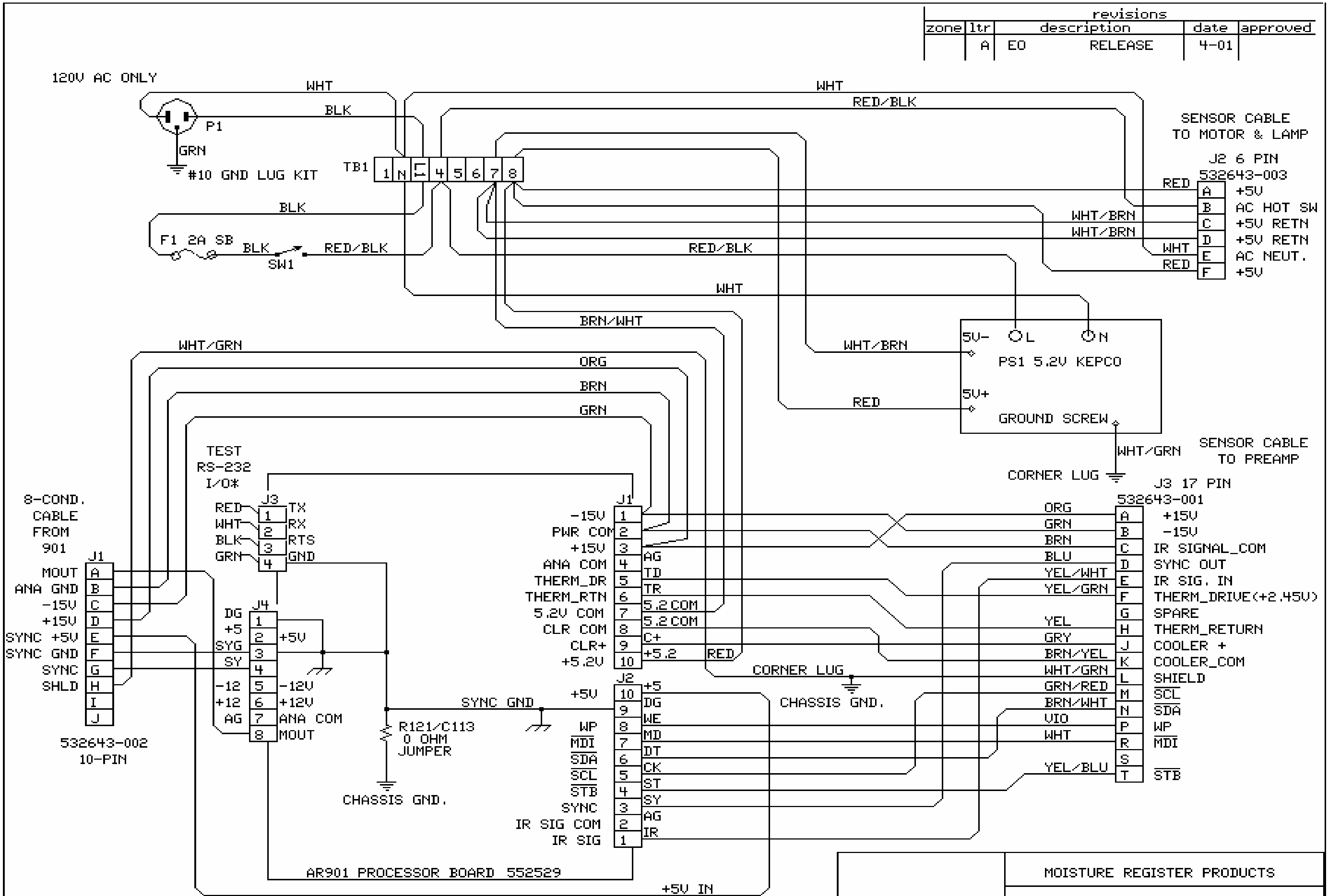
901 AUTORANGE BOX ASSEMBLY

MOISTURE REGISTER PRODUCTS

DIVISION OF AQUA MEASURE INSTRUMENT CO.

1712 EARHART COURT LA VERNE, CA. 91750

NEXT ASSY.	SYSTEM
USED ON	901 IR
FILE NO.	552524.DWG
DATE	2-12-01
DRAWN BY	R. STRIEWSKI
APPROVED BY	
DWG. NO.	552524
SHEET 1 OF 1	



* 1. 552534 J3 USED FOR TESTING LOP & CAL.SIG. w RS-232 SMART II COMMUNICATOR.

NOTES: WIRE TO 552536

prepared	R.S. 2-01
checked	
engineer	R.S.
file: 552533.SCH	
next assy. 552534	

MOISTURE REGISTER PRODUCTS

AR901 PROCESSOR BOX ASSY.

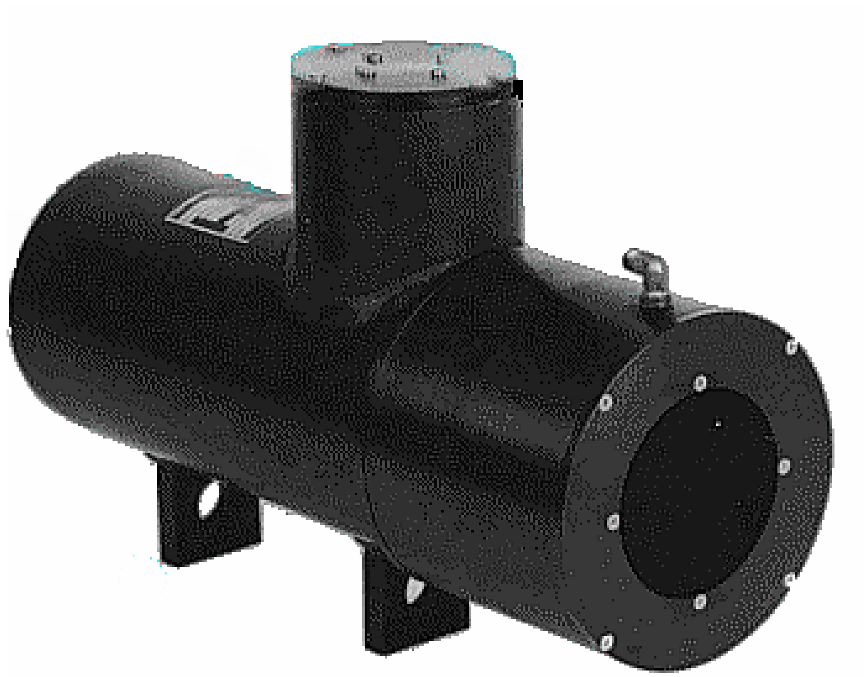
(SCHEMATIC DIAGRAM)

size	code id no.	drawing no.
B		552533
scale		sheet 1 of 1

MOISTURE REGISTER PRODUCTS
A Division of Aqua Measure Instrument Co.

DUST SHIELD

For NIR1A Sensors and IR-III Sensors



Dust Shield attached to IR Sensor

The Dust Shield ensures that your IR Sensor will provide consistent and accurate results by preventing the build-up of dust and grime on the IR Sensor lens that can occur in production environments.

The Dust Shield requires a constant flow of clean, dry air at 10 PSI, 2-3 CFM connected to the provided air pipe. This stream of air is directed towards the front lens, keeping dust from accumulating on the lens. It is recommended that air be controlled with a regulation valve.

MOISTURE REGISTER PRODUCTS
A DIVISION OF AQUA MEASURE INSTRUMENT CO.
P. O. Box 369 - 1712 Earhart Court. La Verne, CA 91750-0369
Phone: (909) 392-5833 - Toll Free: (800) 9-MOISTURE
Fax: (909) 392-5838 - e-mail: aquamoist@aol.com
Web Page: http://members.aol.com/aquamoist

Represented By:

DUST SHIELD INSTALLATION INSTRUCTIONS
DWG. 552278

The *Moisture Register Products*, Dust Shield Part No. 551766 is connected to the NIR Sensor by way of the four socket head screws provided. Use Drawing No. 551929 for mounting dimensions.

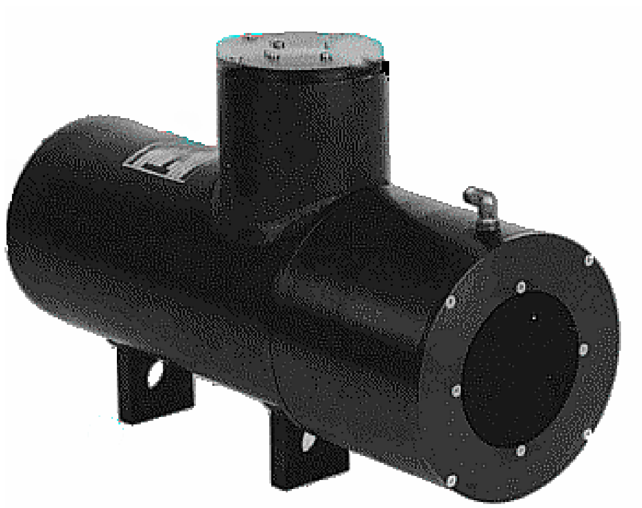
1. Remove the front cover of the Dust Shield (if not removed already), by removing the eight (8) 6-32 1/2" screws.

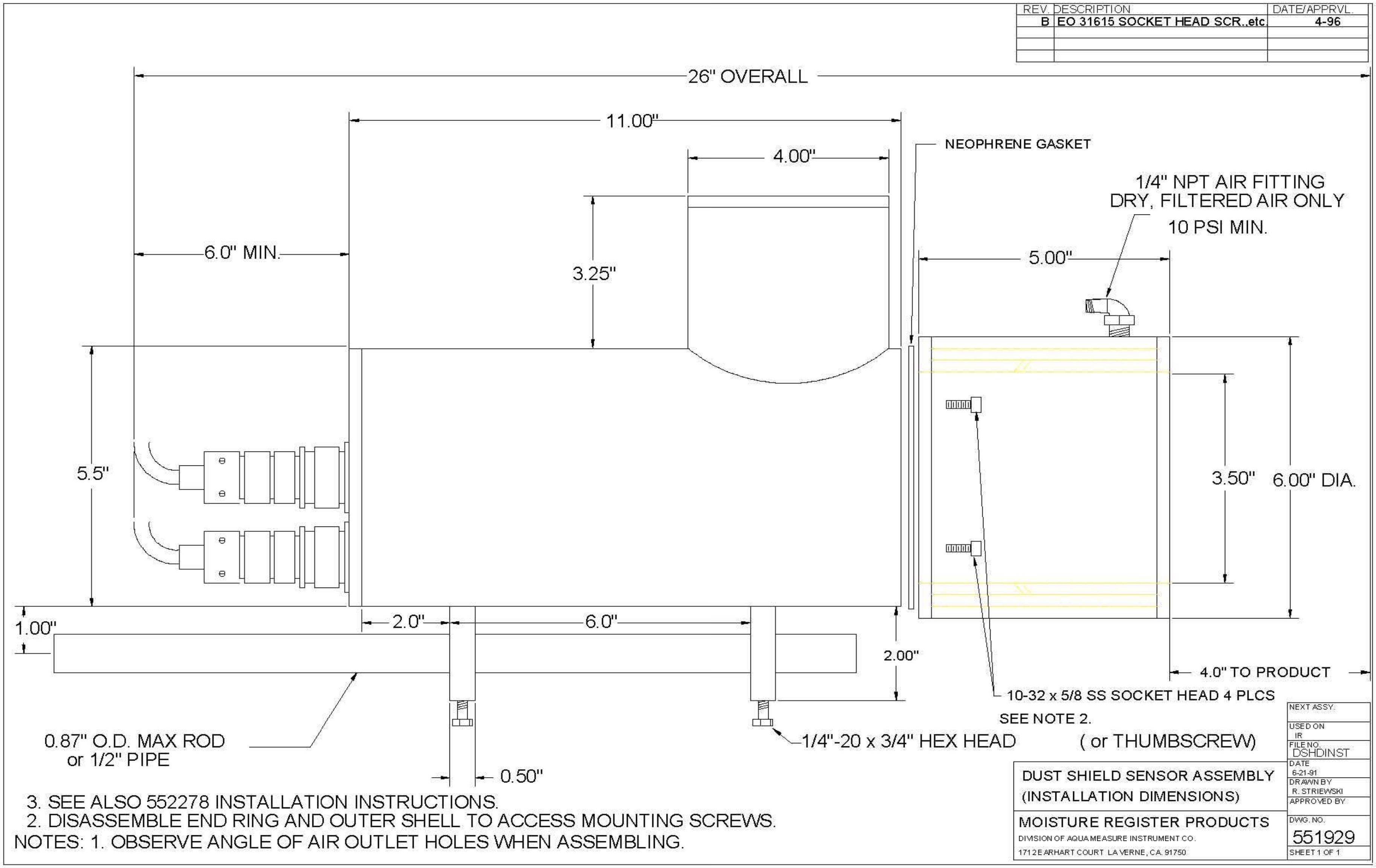
2. Align the rear of the Dust Shield with the front of the NIR Sensor and screw the four (4) 10-32 x 5/8" socket head screws.

3. Replace the front cover using the eight (8) 6-32 x 1/2" stainless steel screws provided. Four of the screws go into the inner ring and the other four into the outer ring.

4. Install constant clean plant air, minimum requirements of 5 PSI, 2-3 CFM dry air. It is recommended that the air be controlled with a regulation valve.

5. Note: The air must flow towards the front lens of the NIR Sensor. If the air flows downward, away from the lens you have assembled the Dust Shield backwards. Repeat Steps 1-5.




REV. DESCRIPTION DATE/APPRVL.
B EO 31615 SOCKET HEAD SCR..etc. 4-96
26" OVERALL
11.00"
4.00"
NEOPHRENE GASKET
1/4" NPT AIR FITTING
DRY, FILTERED AIR ONLY
10 PSI MIN.
6.0" MIN.
3.25"
5.00"
5.5"
3.50"
6.00" DIA.
1.00"
2.0"
6.0"
2.00"
4.0" TO PRODUCT
10-32 x 5/8 SS SOCKET HEAD 4 PLCS
SEE NOTE 2.
0.87" O.D. MAX ROD
or 1/2" PIPE
1/4"-20 x 3/4" HEX HEAD
(or THUMBSCREW)
0.50"
3. SEE ALSO 552278 INSTALLATION INSTRUCTIONS.
2. DISASSEMBLE END RING AND OUTER SHELL TO ACCESS MOUNTING SCREWS.
NOTES: 1. OBSERVE ANGLE OF AIR OUTLET HOLES WHEN ASSEMBLING.
DUST SHIELD SENSOR ASSEMBLY
(INSTALLATION DIMENSIONS)
MOISTURE REGISTER PRODUCTS
DIVISION OF AQUAMEASURE INSTRUMENT CO.
1712 EARHART COURT LA VERNE, CA. 91750
NEXT ASSY.
USED ON
IR
FILE NO.
DSHDINST
DATE
6-21-91
DRAWN BY
R. STRIEWSKI
APPROVED BY
DWG. NO.
551929
SHEET 1 OF 1

REMOTE OPERATOR SOFTWARE

Calibration Management and Presentation For the BSP-901 Moisture Analyzing System.

Bringing moisture control into the PC Age, the Remote Operator Integrates micro-controller technology with innovative software and hardware engineering. The Remote Operator uses a RS-232C link between the BSP-901 console and a PC, work station, or PLC so that calibrations can be entered and loaded with only a few keystrokes. The number of calibration tables maintained is limited only by the amount of memory available on the computer hard drive. Three easy to understand entry screens guide the user, regardless of experience, through the calibration process. Use your keyboard, mouse or the Command String feature to change the BSP-901 parameters.

OPERATING PANEL SCREEN

Shows the current moisture reading and the calibration table in use.
Use your mouse or keyboard to access the operating utilities.



- Shows the Calibration Table in use.
- Diplays the current Moisture Reading
- [MOIST] displays the moisture content.
- The [CALIB] key shows the calibration signal of the product being measured.
- When used in conjunction with other keys, [FUNCT] accesses the many features of the BSP-901.
- [PREV] returns you to the previous function.
- [CALIB. UTILITIES] advances the program to the next screen, where data for calibration tables can be entered.
- All these features can be accessed through the [COMMAND STRING] feature.

CALIBRATE BSP-901 SCREEN

Use this screen to enter data for the calibration tables.



- Customize the operating characteristics of the BSP-901 using the Other Parameters and Alarm Levels options.
- Saves the calibration data and other operating parameters to a file.
- The number of files saved is limited only by the hard drive of your computer.
- All calibrations saved as files can be instantly accessed for reference or modification.

SPECIAL OUTPUT COMMANDS SCREEN

This screen is used for the following purposes.



- Scaling the 4-20 mA output current.
- Program the Sample on Command setting.
- Modify measurement and process Control Options quickly and easily.

Manufactured in the United States of America.

Programming Hints for using the BSP-901 Remote Operator

Operating the BSP-901 remotely is done in exactly the same manner as is done when physically operating the unit via. the front panel touch keyboard. The Remote Operator allows this to be done from a remote RS-232 link, and from a computer. Thus, new calibrations can be quickly and accurately entered for applications where more than five products are being monitored.

The programmer needs to familiarize himself with the various Function Commands which are used to program the 901. Note that numerical calibration data can be entered with only the required decimal accuracy (up to a total of 4 numerical characters).
As an example, a calibration string might look like this:
"FC41.234F4.00F1.345F5.00F9999F9999F" or like this:
"FC41.234F4F1.345F5F9999F9999F", where the decimal zeros on the moisture content entries have been dropped. Note that the Remote Operator will only accept the same set of Capital Letters which appear on the touch panel keyboard.

Remember that entry by hand directly from a keyboard must be slow enough (0.5 sec. per character) for the Remote Operator to respond individually to each command character. Automatic entry from a Terminal Program will be fast enough so that the Remote Operator will accept and store the entire string before execution. In this case the Operator will show Busy for the total number of characters times 0.5 sec.

There are some instances in the operation of the 901 where remote programming can be confusing, even with the constant read-back of the display. Thus it is necessary to assume that the 901 may be in a condition where it will not accept the first programmed character with the intent for which it was sent.

The 901 software is such that when any Function (`F') commands are started, such as `FC' which starts the calibration sequence, the 901 display is not continuously updated until the entire calibration sequence is completed. The display is only updated after the entry of each successive character. Therefore, assume that a single `F' character was received either from the touch panel keyboard, or from the RS-232 link. The automatic update of the display will be interrupted while the unit waits for the balance of the commands.

Now, assume that it is desired to select Calibration Table 2. If `M2' is sent from the host, the 901 will go into the sequence which starts `FM2', since the `F' has already been entered. Alternately, if only the number `2' is sent the 901 will display the results for entering `F2', which is Loss of Product.

Programming Hints for using the BSP-901 Remote Operator.

We can get around this problem by examining the read-back from the 901 display at the Host computer for a correct moisture indication (A2 3.45) prior to sending a new set of commands. If this indication is expected and not there, it will be necessary to clear the partial entry before sending the new commands.

The `C' command causes the display of the Calibration Signal immediately from any programming location except when a single `F' has already been entered. In this case, by entering the `C' command again a return to the Cal. Sig. display will result. Therefore, to easily regain control of the 901 irrespective of where the programming entries may have halted, it is only necessary to send the `CC' command immediately prior to any other command, or calibration command string.

Please refer to other documentation which has been written about the Remote Operator, as well as the BSP-901 Operators Manual for additional information related to the programming and interpretation of the 901 display read-back.

end - rmprog.doc
September 16, 1994

BSP-901 REMOTE OPERATOR BOARD ADD-ON

GENERAL DESCRIPTION: The Remote Operator is programmed via an RS-232 link from a host or controlling computer or P.L.C. Programming is done in the same code as would be entered if the 901 front panel keypad was actuated manually. `C' is sent when the unit is commanded to the Calibrate display, `M2' is sent when moisture calibration #2 is selected, etc.

The Remote Operator will also accept string files of up to 64 characters allowing a full calibration table to be entered. The character strings are stored in RAM memory in the Operators micro-controller unit until the transmission from the host stops. End of transmission is detected by the absence of characters on the RS-232 line permitting a three wire connection to the host if no hardware hand shaking is used.

When no activity is detected on the incoming line, the Operator begins execution of the stored character commands in the sequence that they were received. Each execution takes 0.5 sec., so a full memory string will take 32 sec. to complete execution. An RTS line is available for the host which is set to the busy condition when command execution is taking place. The CTS signal from the host is not used.

Command execution is achieved when the Operator closes one of 16 electronic switches which are in parallel with the respective front panel key pad switches. The Operator closes the switch for 1/6 sec. which is compatible with the 901 software timing. One third of a second is then allowed for the 901 to react to this command.

To enable error checking of the transmitted data, the Operator echos-back each character as it is received on a bit by bit basis. Error checking must be done at the host by comparing the transmitted string with the echoed-back string. If a match is achieved, it is assumed that the 901 operated correctly on the transmitted command string. If a wrong character was received by the 901, that character is ignored, and the balance of the string of characters is executed.

Thus, when a transmission error is detected at the host, it is necessary to send the string again after waiting the required execution time according to the number of characters sent, or for the busy signal on the RTS line to clear.

RS-232 SPECIFICS: The RS-232 protocol is 9600 baud, 8 bits, no parity, 1 stop bit. A minimum three wire RCV, XMIT, GND system can be used, but with the added RTS line, more flexibility will result in data transmission timing. These parameters are programmed into the software, and are not able to be changed in the field. The RS-232 signal swings between plus and minus 7.5 V levels, providing good noise immunity for long cable runs.

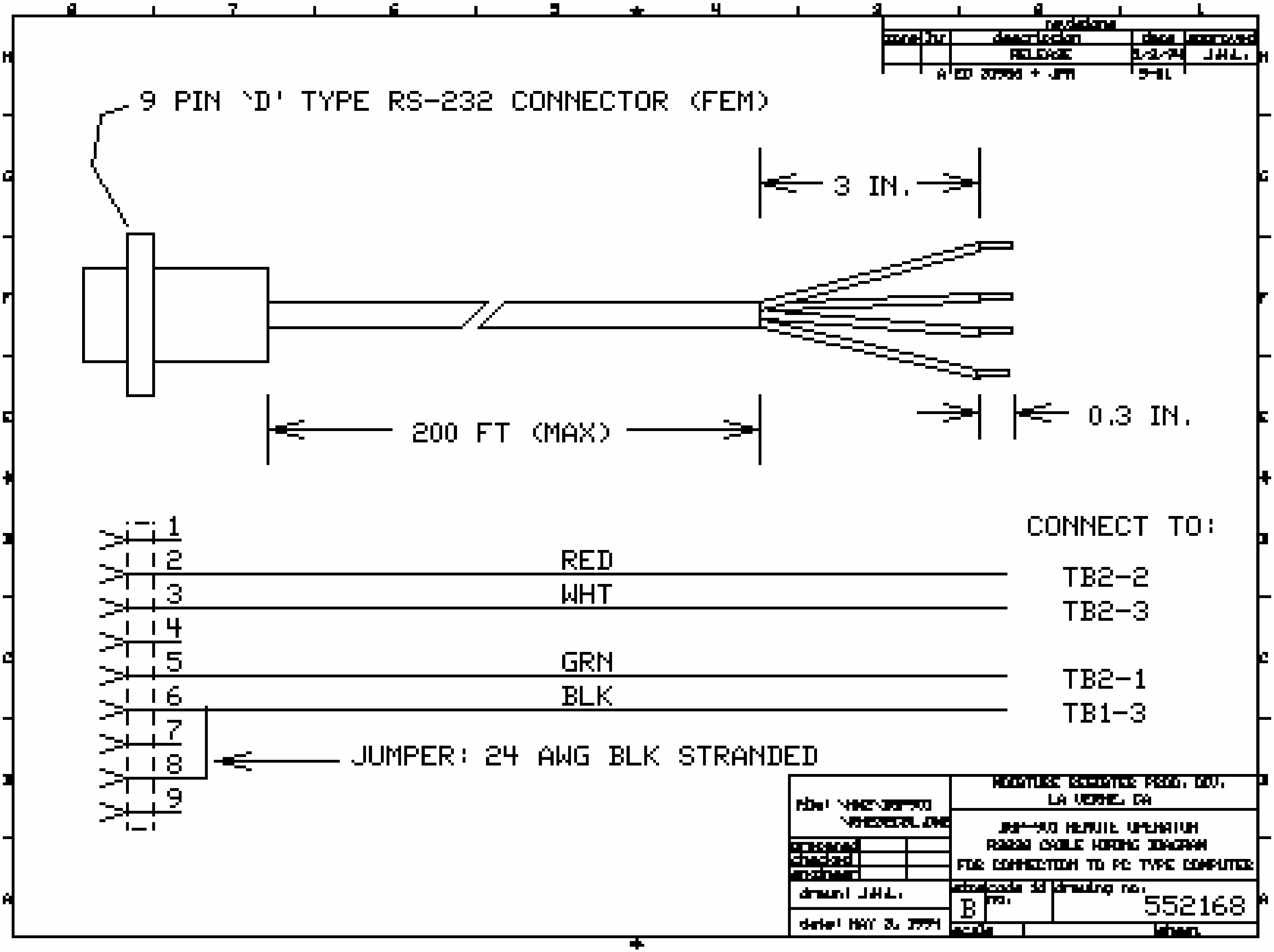
The RS-232 electronics are fully isolated from the BSP-901 electronics by devices and spacings rated for 1500 V.

PHYSICAL CHARACTERISTICS: The Remote Operator is configured as an add-on board which is `piggy-backed' to the 901 display circuit board. Three plastic circuit board mounts are fastened to existing holes in the display board to hold the Operator board. The ribbon cable to the display is removed, the Operator board is plugged into the display board, and the ribbon cable plugged into the socket on the Operator board. Screw connectors are provided on the Operator board for the RS-232 wiring to terminate.

No adjustments are required on the Operator board, as all timing is controlled by the clock crystal oscillator and software.

APPLICATIONS: The Remote Operator is a solution for those customers who have the requirement for measurement of more than five different materials. Using any terminal type software, calibration command files can be transmitted to the Remote Operator from any PC type computer.

end - remoper.doc


9 PIN 'D' TYPE RS-232 CONNECTOR (FEM)
3 IN.
200 FT (MAX)
0.3 IN.
CONNECT TO:
1
2
3
4
5
6
7
8
9
RED
WHT
GRN
BLK
TB2-2
TB2-3
TB2-1
TB1-3
JUMPER: 24 AWG BLK STRANDED
LA VERNE, CA
FOR CONNECTION TO PC TYPE COMPUTER
B
552168

AQUA MEASURE INSTRUMENT CO.
MOISTURE REGISTER PRODUCTS DIVISION
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OPTO-PORT

Automatic Sampling System

The Opto-Port is a patented sampling device for use with the Smart II Moisture Measuring System and the BSP-901 moisture analyzing systems.

The Opto-Port assembly allows for moisture measurement of powdered materials within a closed conveying system. The stainless steel Opto-Port is attached to a Moisture Register Products' NIR Sensor, and is installed directly into the conveying system. Product moisture is read through a quartz window at the end of the Opto-Port.

We also produce an explosion proof version for sensitive environments.





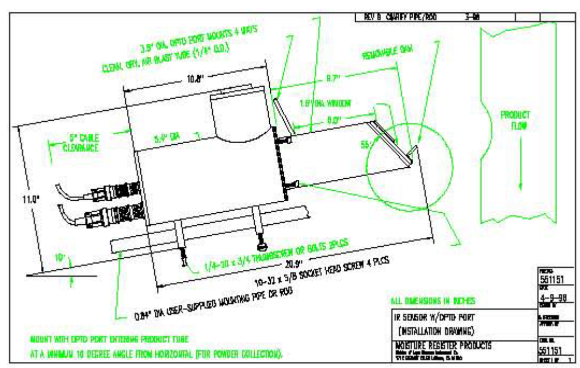
Opto-Port mounted on a explosion proof housing.

Opto-Port Without Air

The Opto-Port Without Air is designed to be mounted directly through the sidewall of a conveyor or hopper, where new product is constantly being pushed across the face of the quartz window. The Opto-Port Without Air must be inserted into the system far enough to prevent material build-up. When installing the Opto-Port Without Air in a screw conveyor, it may be necessary to cut one or more flytes to obtain this distance.

Opto-Port with Air

The Opto-Port with Air is mounted at an angle that allows material to build up on the stainless steel dam below the quartz window. After the accumulated material has been measured, a pulsed airstream is directed across the face of the window to clear the product away, allowing a new sample of material to accumulate. An adjustable source of clean, dry air is required.



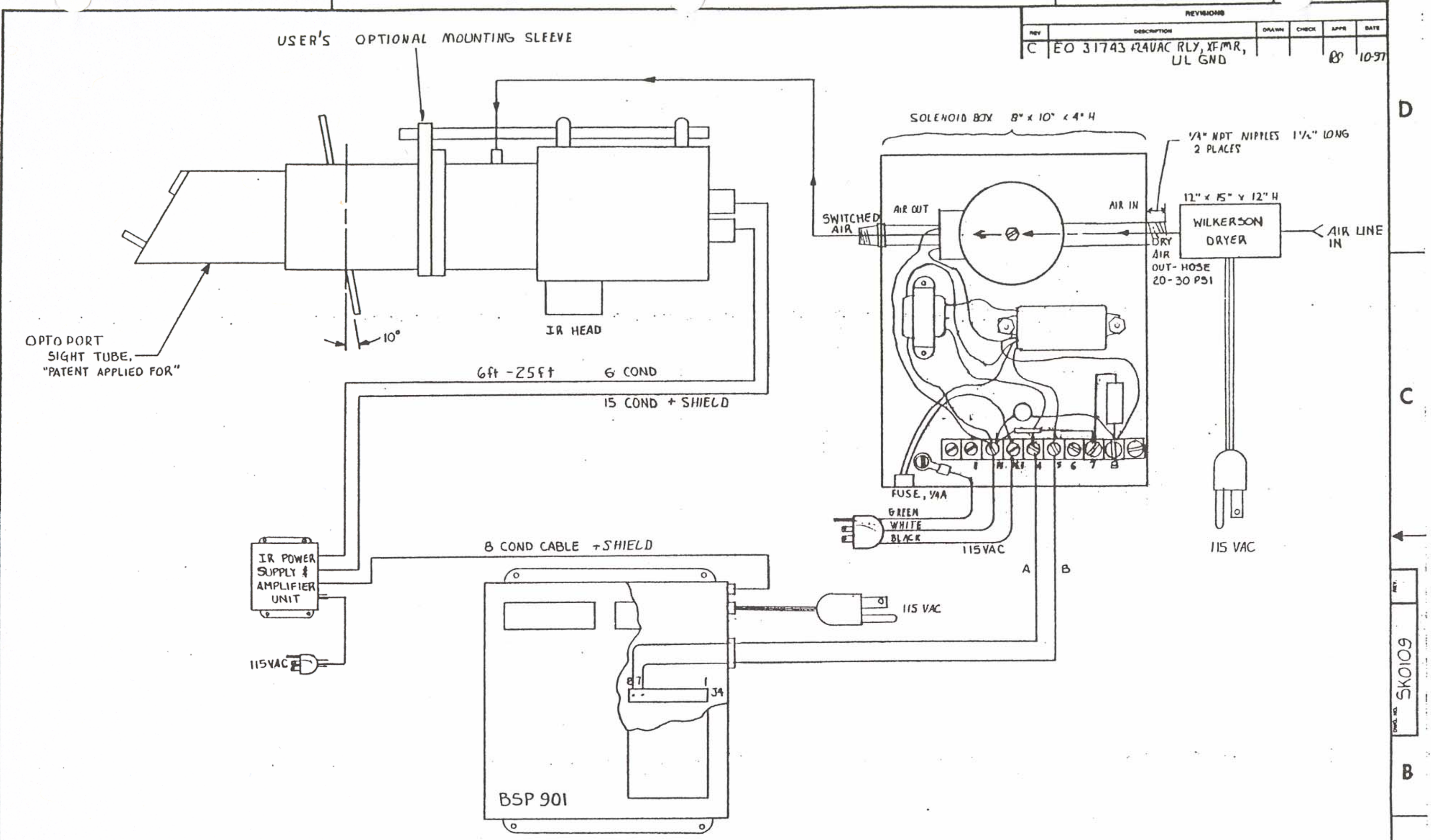
OPTO-PORT ATTACHMENT

Unique to the Moisture Register Products on-line systems Models BSP-901, BSP-4004, SMART-II IR and MCP-1 Systems is our patented sampling device, the OPTO-PORT. The OPTP-PORT is a stainless steel sampling fixture that attaches to the IR Sensor allowing adaptability to a variety of difficult sample handling situations. This unique assembly was initially designed for use in the milk powder industry. The OPTO-PORT assembly allows for the moisture measurement within a gravity drop pipe of an otherwise close pneumatic conveyance system. The IR Sensor is affixed to the OPTO-PORT, which is then installed directly through the sidewall of the drop pipe. In this installation the protruding end of the viewing point is cut at a 35° angle and contains a transparent optical quartz window. A stainless steel dam is attached across the end of the OPTO-PORT just below the quartz window. The purpose of the dam is to cause an accumulation of material on the surface of the quartz window for moisture measurement by the IR sensor. A high pressure pulsed air stream is directed across the face of the window to clear the surface of previously measured material at programmable intervals.

The OPTO-PORT without the air attachment can also be mounted directly through the sidewall of a conveyor where the force of the screw flytes pushes new product across the face of the quartz window. The window must be constantly cleaned by the flow of the new product. The OPTO-PORT must be inserted into the screw conveyor wall to a distance past any build up of old product; it is sometimes necessary to cut part of one or more screw flytes to obtain distance.

MOUNTING ARRANGEMENTS

The stainless steel OPTO-PORT is installed to the IR Sensor by four (4) 10-32 X 7/16 screws. A rubber gasket between the IR Sensor and the OPTO-PORT maintains a proper dust and water seal. Mounting the complete OPTO-PORT through the sidewall of a drop chute or conveyor can be done very easily and inexpensively.



3. TO TEST, SHORT TB1 - 4 TO 5.

2. J4-7 GOES TO A, J4-8 GOES TO B.
1. TURN OFF U23-S2. PRESS SW2 (RESET).

NOTES: UNLESS OTHERWISE SPECIFIED

MOISTURE REGISTER PRODUCTS

BSP 901 BLOWER CONNECTION

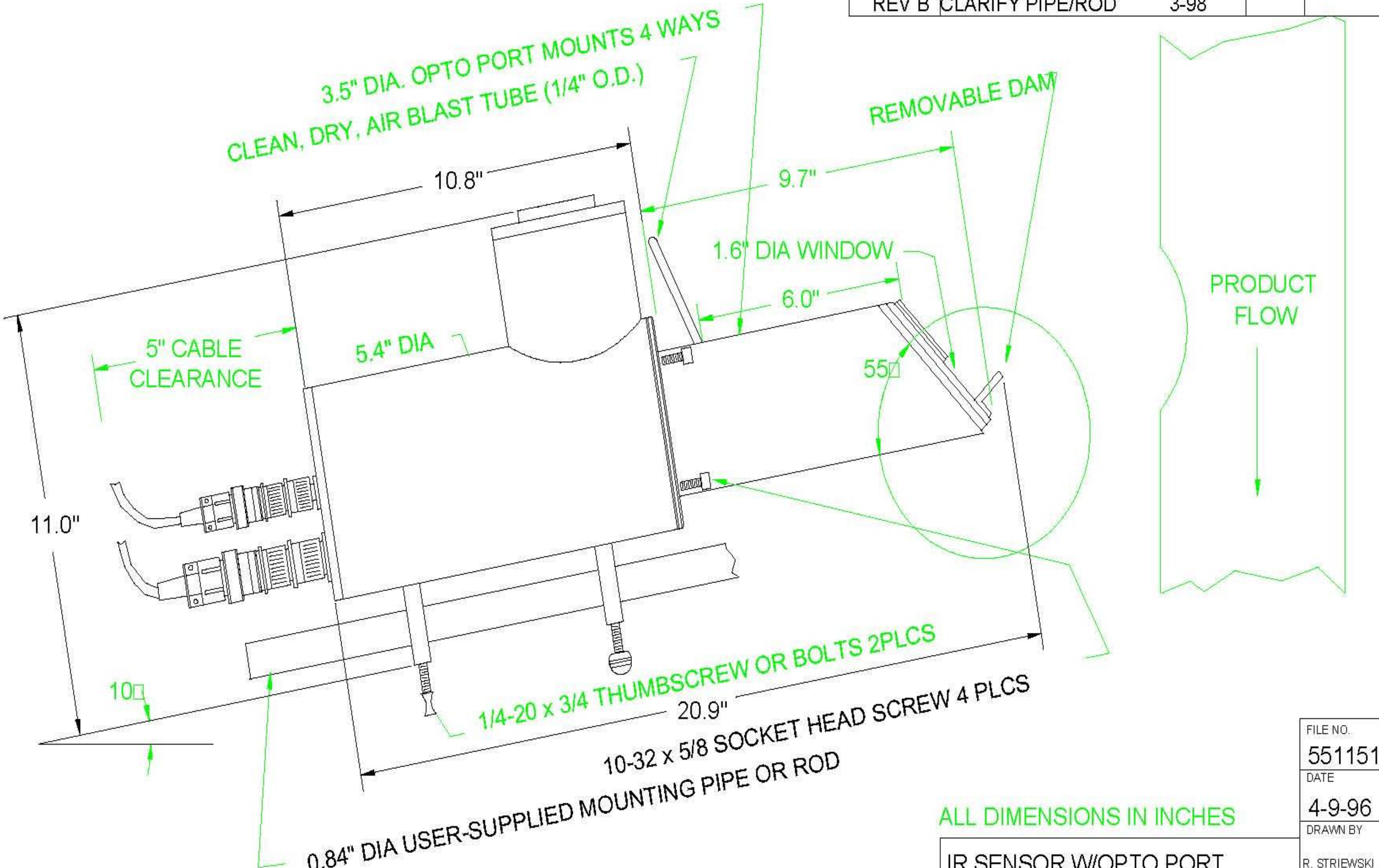
SIZE	FSCM NO.	DWG. NO.	REV.
C	14506	SK0109	C

DRAWN E S STEWHARD 4/11/84 — CHECKED 5/4/84 — 10-18-91 RS

SCALE ~ — SHEET 1 OF 1

DO NOT SCALE DRAWING — APPLICATION

REV B	CLARIFY PIPE/ROD	3-98		



ALL DIMENSIONS IN INCHES

MOUNT WITH OPTO PORT ENTERING PRODUCT TUBE

AT A MINIMUM 10 DEGREE ANGLE FROM HORIZONTAL (FOR POWDER COLLECTION).

IR SENSOR W/OPTO PORT (INSTALLATION DRAWING)	FILE NO. 551151
	DATE 4-9-96
	DRAWN BY R. STRIEWSKI
	APPROV. BY
MOISTURE REGISTER PRODUCTS Division of Aqua Measure Instrument Co. 1712 EARHART COURT LaVerne, CA 91750	DWG. NO. 551151
	SHEET 1 OF 1

BSP-901 TROUBLE SHOOTING QUESTIONS.

Company Name:____________________________

Address:____________________________

Telephone:________________ Fax:________________

Contact:____________________________

E-mail:____________________________

What is the product?

What is the moisture range of the product?

What is the color of the product?

Any small or large shiny pieces in the product?

What other additives are added to the product and to what percentage?

What is the temperature of the product?

Is it maintained?

How closely?

How is the product being transported?

Does it vibrate?

What is the ambient temperature where the Sensor is mounted?

What is the air temperature between product and Sensor?

Does it change?

How much?

What is the Sensor body temperature?

Does it change?

How cuch?

How often?

What is the Calibration Signal reading in the test mode inside the BSP-901 console?

What is the Test Plate Calibration Signal reading (NIR Sensors only)?

What is the Loss of Product Signal looking at product? F2

What is the Loss of Product Signal without product? F2

What calibration table is being used?

1[St] Calibration Signal____________ 1[St] Moisture ____________

2[nd] Calibration Signal____________ 2[nd] Moisture ____________

3[rd] Calibration Signal____________ 3[rd] Moisture ____________

How is the BSP-901 calibrated?____________________________